Fungus moths: a review of the Scardiinae (Lepidoptera: Tineidae)

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Contents

Synopsis 37
Introduction 37
Techniques 40
Check-list of Scardiinae 41
Taxa excluded from the Scardiinae 43
Classification and characters – but phylogeny? 43
  Objectives 43
  Methods 43
  Supraspecific groups (OTUs) classified 46
  Characters used in classification 46
  Results 50
Geographical distribution 58
Abbreviations 60
Acknowledgements 60
Scardiinae Eyer 61
References 135
Index to hostplants and fungi 180
Index to Lepidoptera 180

Synopsis

This paper gives an account of the subfamily Scardiinae, the fungus moths. The group is redefined and 111 species in 23 genera are ascribed to it. Its previous taxonomic history and its biological and morphological characteristics are reviewed. Le Quesne tests show homoplasy to be rampant in the Scardiinae. Numerical phylogenetic methods are used with the aim of deriving a phylogenetic classification; their results are contrasted with those from various phenetic methods. Character-compatibility analysis is used to pinpoint 'robust' characters with minimal homoplasy. Groups defined by such characters are found to be also 'robust', being revealed by most of the analytical methods employed. The shortest optimized Wagner tree is adopted as the classification but the limited phylogenetic implications of this classification are stressed. The biogeography of the group is reviewed. Keys are provided to genera and species. Eight genera are described as new and one genus is recalled from synonymy. Twenty-six new species are described and 18 species are placed in new generic combinations; four new synonymies are established.

Introduction

The subfamily Scardiinae includes more than one hundred species of generally large and robust tineid moths. While the smallest species have a wingspan of only about 12 mm, the largest Scardiinae are among the biggest ditrysian Microlepidoptera, with wingspans of up to 60 mm. Despite their size, however, Scardiinae are not conspicuous.

It is the biology of the Scardiinae that sets them apart, with one exception, from all other subfamilies of Lepidoptera. The larvae feed in either the fruiting body (sporophore) of persistent (hard) bracket-fungi, or in the wood of dead or moribund trees that has been permeated by the hyphae of such fungi. The traces left by feeding scardiinae larvae are characteristic – ramifying accretions of loosely webbed coarse frass forming a cover for surface and sub-surface feeding, usually combined with similar volcano-shaped accretions of frass or

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loose mounds above deeper tunnels. Larvae pupate just below the surface of the food-substrate. The mobile pupa is protruded half-way out of the substrate (using two rows of backward-pointed spines on each abdominal segment to force its exit) before it ruptures and the adult emerges.

Fungus-feeding Lepidoptera

Examples of fungivory are found throughout the Lepidoptera and the reader is referred to the recent review by Rawlins (1984) for further details. Within the Tineoidea fungivores are found possibly among the species of *Compsoctena* (Eriocottidae). Lichenivory, a form of fungivory, is widespread among Psychidae. The biology of one of the eight species of Arrhenophanidae is known and it is a fungivore, feeding on '*Polyporus* sp.' (Costa Lima, 1945; Becker, pers. comm.). Within the Tineidae fungivory is found in the subfamilies Hieroxestinae, Tineinae and Meessiinae (Lawrence & Powell, 1969); many other species of Meessiinae are lichenivores. However, apart from the Scardiinae, the tineid subfamily Nemapogoninae is the only other subfamily of Lepidoptera that feeds exclusively on fungi. Nemapogoninae are virtually restricted to the Holarctic region whereas Scardiinae are found also in both the Old and New World tropics. There is no obvious division of niche between the two groups but there is a considerable size difference, most adult Nemapogoninae having a wingspan of less than 18 mm, with the larvae being correspondingly smaller than those of Scardiinae.

General morphology

The wing patterns of most genera of Scardiinae are cryptic, taking the form of a mottled cream and brown pattern resembling moss or tree-bark. Other genera have disruptive patterns: the brown forewing with a pale apex and dorsum. A few genera have a bronze or golden forewing ground-colour blotched with dark brown. The *Morophaga bucephala*-group is quite atypical in having a conspicuously white forewing ground-colour with bold purple-brown markings. In *Amorophaga* the cryptic wing-pattern is corrupted by being drawn into longitudinal streaks.

The scardiine head carries the erect scales on frons and vertex typical of most tineid groups. The maxillary palpus is 5-segmented, elongate and folded in most species. The labial palpus is cylindrical, the second segment with only lateral bristles rather than lateral and terminal bristles as in, for example, the Tineinae. The antennal pecten may be very large with up to about 40 strong, bristle-like scales.

Most species are broad-winged and have all veins present. However, some have narrow forewings and in these one or two pairs of veins are stalked. The narrowing of the forewing is most extreme in *Diataga*, in which two pairs of veins are stalked. Externally, however, the morphology of adult Scardiinae is conservative and, with the exception of the enlarged antennal pecten (not found in all scardiinae genera but not known from any other tineid), no adult character or combination of characters can be used to define the group. It is the larva that provides the single defining character of the Scardiinae (see below).

History of classification of the Scardiinae

Although Eyer (1924) is the first recorded user of the family-group name Scardiinae, the association of typical scardiine taxa was well-established by earlier authors (e.g., for the New World, by Dietz, 1905, and Walsingham, 1914). No significant usage of the family-group name occurred again, however, until Hinton (1955; 1956) emphasized the characteristic for defining *Scardia* (i.e., *Scardia s.l.: Morophaga* + *Scardia* + *Morophagoides*) and its allies as a discrete group.

The larvae of Scardiinae differ from those of all other Tineoidea in that the prothorax bears only two L-group setae. All other known tineid larvae have three L-group setae. The generality of this important character within the Scardiinae is, however, uncertain as larvae of only *Morophaga, Diataga, Scardia, Daviscardia* and *Morophagoides* are known. The characteristic larval setation was first noted by Gerasimov (1937) in *Scardia*. Fracker (1915) had earlier figured the larva of *Scardia anatomella* but with three prothoracic L-group setae. However, this was

probably an error as later workers (Kuznetzov, 1941; Hinton, 1956) found only two. Kuznetzov (1941), finding a fossil larva with only two L-group setae, searched for this character among other Tineidae and confirmed it in *Morophaga choragella* (as *boleti*), *Scardia boletella, S. anatomella* and *Daviscardia coloradella*. Strangely, his mention *en passant* of *coloradella* is the only reference to the setal pattern of this species and confirms the bisetose prothoracic L-group in *Daviscardia*.

Amsel (1952) figured the genitalia of the few European species of Scardiinae. Petersen (1957) placed together all those Palaearctic species of Scardiinae then recognized and described the genitalia. He later (Petersen, 1959; 1960) described two new species and revised those known to him.

Zagulajev (1965; 1966; 1968) described a number of new species from the Caucasus and from the easternmost provinces of the U.S.S.R. and later (Zagulajev, 1973) combined and expanded his earlier work into a full-scale monograph of the Palaearctic Scardiinae. This work remains the primary reference to the group in this area and no attempt is made here to duplicate its content. Gozmány & Vári (1973), in their monograph of the Afrotropical Tineidae, also recognized the subfamily as discrete and revised the Afrotropical species. Their concept of the Scardiinae was, however, broader than that of other authors. They included *Afrocelestis*, *Ateliotum* and *Pelecystola*, genera placed by other authors as Meessiinae (*Afrocelestis*) and Myrmecozelinae (*Ateliotum* and *Pelecystola*), placements that I endorse. They also erected a further subfamily, the Tinissinae. Three years later I revised this diverse group of predominantly south-east Asian species (Robinson, 1976*a*) and later proposed a phylogeny for the group, drawing attention to its morphological similarities to the Scardiinae and suggesting that the Scardiinae might be paraphyletic with respect to the Tinissinae (Robinson, 1981). This suggestion is supported in the present work and the Tinissinae are synonymized with the Scardiinae below.

Davis (1983) has provided an up-to-date list of the North American Scardiinae, including new synonymy: work in progress includes redescription of the North American Scardiinae (Davis, pers. comm.).

The action of Căpuşe (1971) in erecting the tribe Semeolonchini for the single genus *Semeoloncha* is based on no more than Gozmány's original description of the genus (Gozmány, 1968); no characteristics are offered to define the tribe and it is not placed in any higher taxonomic category.

Fossil 'Scardiinae'

Kuznetzov (1941), in his revision of the Lepidoptera of Baltic amber (~40 million years BP), described four genera (*Scardiites, Proscardiites, Palaeoscardiites* and *Glessoscardia*) and allied them with *Scardia* (and thus with the Scardiinae). Zagulajev (1966; 1973) agreed with Kuznetzov's placement. The first three genera were described from single adults, the last from a larva. The possibility that *Scardiites* is a monotrysian is suggested by a row of postfrenular bristles in Kuznetzov's illustration, the shape of the apex of the abdomen of *Proscardiites* suggests the possibility of its being a yponomeutoid (although the length of the maxillary palpi suggests otherwise), and the outline of the valva of *Palaeoscardiites* as figured by Kuznetzov is reminiscent of *Compsoctena* (Eriocottidae). There are no characters figured or cited by Kuznetzov to suggest affinity of *Scardiites, Proscardiites* or *Palaeoscardiites* to the Scardiinae. However, the larva, *Glessoscardia*, could well be a Scardiinae although from its size (only 9 mm long) it is unlikely to be mature. Kuznetzov noted that it had only two prothoracic L-group ('prestigmatal') setae.

General biology

A summary of the biologies of the Palaearctic Scardiinae (including novel information on some species, and figures of the larva and pupa of *Scardia boletella*) has been given by Zagulajev (1973). Powell ([1968]) and Lawrence & Powell (1969) bred Lepidoptera from a variety of dead wood and fungus samples in California. This rearing programme yielded a large number of new host records for North American Scardiinae. Much earlier, Walsingham (1882) described his

experiences rearing *Scardia anatomella* in Oregon. Hinton (1956) has noted the few detailed descriptions of the biology of European species. Petersen (1969) has summarized records of the biology of *Morophaga choragella* (as *boleti*). More recently, Moriuti (1976) has described the life history of *Morophagoides moriutii* (as *ussuriensis*) and figured the larva and pupa.

Scardiinae are only rarely encountered in collections made at light (Robinson, 1981 – *Tinissa*). Sixteen nights' collecting at light in Brunei in 1982, for example, yielded 260 Tineidae of about 60 species: only six species and eight individuals were Scardiinae and all but one of those were *Tinissa* (Robinson, 1984). Species of Scardiinae of which large numbers are available have almost invariably been bred. Zagulajev (1973) has collected numbers of *Morophagoides iranensis* swarming at dusk near fungus-riddled trees and Fletcher (1933) collected *Morophaga cremnarcha* (q.v.) under similar circumstances. Other specimens have been collected at rest by day close to a putative food-substrate.

Scope and aims of the present study

The present study is intended to complement existing studies of the Palaearctic Scardiinae, notably that of Zagulajev (1973), by integrating the comparatively unstudied species and genera of the Old World tropics and of the New World with the Palaearctic taxa. In so doing, it has been necessary to revise substantially the existing classification of the Scardiinae and, to some extent, to adapt the restricted definition of the sub-family to accommodate the morphological differences of the extra-Palaearctic taxa.

The bibliography provided is limited in that references providing only minimal information (such as mention in checklists, or parochial distribution records of common European species) have been omitted. Zagulajev (1973) has collected together many references to European species and others are given by Petersen (see bibliography): they are not reiterated here.

This review is based primarily upon the collections of the British Museum (Natural History) but most specimens in the National Museum of Natural History, Washington, the University of California, Berkeley, and the Zoological Institute of the Academy of Sciences, Leningrad, have also been studied. Material in other institutions was requested selectively. Specimens in Leningrad and California and some of those in Washington were examined early on in the project and, at that time, not all the characters finally adopted for use in classification had been recognized. Where observations are deficient, this is stated.

Attempts to resolve a phylogeny for the Scardiinae have highlighted the problems caused by the high degree of homoplasy encountered. Gauld & Mound (1982) have drawn attention to this as a feature of several other insect groups and emphasized the difficulty in providing an acceptable generic classification in these circumstances.

The data set obtained in the course of this study has been used in the exploration of techniques for numerical classification by phenetic and cladistic methods using a microcomputer.

Terminology

The external and genital morphology of the Scardiinae is unexceptional and the terminology used here follows that of Common (1970) and Klots (1956). Further discussion of certain of the features examined is given under 'Characters used in classification'. In the male genitalia the uncus is composed of a pair of soft lobes: these may be more or less strongly sclerotized, may be fused with each other and/or with the tegumen, or may be widely separated. In my previous paper (Robinson, 1981) I adopted Kuznetzov & Stekolnikov's (1976; 1977) term 'tegumen lobes' for these, but their clear differentiation from the tegumen in all taxa examined, and their evident homology with the uncus of, for example, the Tineinae, make this term inappropriate and I here revert to my earlier (1976*a*) usage of 'uncus lobes'.

Techniques

Pinned adult specimens were examined at magnifications of ×6 to ×50 in artificial light using a

Wild M5 microscope. Venation, if not visible in oblique light, was examined by transmitted light after the wing had been wetted with toluene.

Size measurements given were made with a ruler and are those of a specimen set in conventional fashion; other comparative measurements were made using an eyepiece graticule on a Wild M5 microscope.

The variety of male genital types in the Scardiinae required the utilization of a variety of techniques to display the characters adequately. General methods for the preparation of genitalia slides have been described by Clarke (1941) and Robinson (1976*b*). For certain Scardiinae it was necessary to employ the technique of cutting the vinculum laterally and unrolling the genital armature as described previously for *Tinissa* (Robinson, 1976*a*). In other groups the internal surface of the uncus lobes and valvae could be displayed simply by folding the valvae ventrad and forward and splaying them slightly. In other groups it was necessary to dissect away one valva and mount it separately. Chlorazol Black E (Azo Black) was employed as a stain for preparations made early on in this study but this was superseded by Mercurochrome. I now prefer the latter stain as it is more controllable and consistent. Although not applicable to this study, it also offers better photomicrographic results.

Preparations were examined and drawn using a Wild M5 stereoscopic microscope with camera lucida drawing attachment. More detailed examination was carried out with a Leitz Ortholux microscope using phase-contrast and magnifications to ×600. Phase-contrast was particularly useful in identifying microtrichia lining the vesica or the ductus bursae, in identifying the sensilla on the eighth tergite of females, and in locating and counting the setae on the abdominal sternites.

Numerical analysis was carried out using a Commodore 64 microcomputer. Programs written by the author are in CBM BASIC; copies are available on request.

When a draft of this paper was completed, David Swofford's computer program 'PAUP' (Phylogenetic Analysis Using Parsimony – Illinois Natural History Survey) became available, running on the Rutherford Laboratory's IBM Multiprocessor. This program was used with multiple parsimony and global branch-swapping options.

Check-list of Scardiinae

MOROPHAGOIDES Petersen, 1957
- ***iranensis*** Petersen, 1960
- ***ussuriensis*** (Caradja, 1920)
- ***moriutii*** **sp. n.**
- ***berkeleyella*** (Powell, [1968])
- ***burkerella*** (Busck, 1904)
  - *gracilis* (Walsingham, 1907)
  - *caryophylella* (Busck, 1908)
  - *errandella* (Busck, 1908)
- ***montium*** (Walsingham, 1914)
- ***pythium*** **sp. n.**
- ***nimbiferum*** **sp. n.**
- ***iulina*** (Walsingham, 1914)

MONTESCARDIA Amsel, 1952
- ***tessulatellus*** (Zeller, 1846)
- ***kurenzovi*** (Zagulajev, 1966) **comb. n.**
- ***fuscofasciella*** (Chambers, 1875) **comb. n.**
  - *pravatella* (Busck, 1908)

BYTHOCRATES Meyrick, 1919
- ***drosocycla*** Meyrick, 1919

DAVISCARDIA **gen. n.**
- ***coloradella*** (Dietz, 1905) **comb. n.**
- ***radulella*** **sp. n.**
- ***bimendella*** (Zeller, 1863) **comb. n.**
- ***beckeri*** **sp. n.**
- ***luctuosa*** (Walsingham, 1914) **comb. n.**
- ***mackiei*** **sp. n.**
- ***bicolorella*** **sp. n.**
- sp. A
- ***lupulella*** **sp. n.**
- ***hypocritella*** **sp. n.**

SCARDIA Treitschke, 1830
- *Agarica* Sodoffsky, 1837
- *Fernaldia* Grote, 1881
- *Duomitella* Koshantschikov, 1923
- ***anatomella*** (Grote, 1881) **comb. rev.**
  - *fiskeella* Busck, 1908
- ***assamensis*** **sp. n.**
- ***amurensis*** Zagulajev, 1965
- ***alleni*** **sp. n.**
- ***boletella*** (F., 1794) **nom. rev.**
  - ‡*boleti* (F., 1798) (unjustified emendation)
  - *polypori* (Esper, [1804])
  - *relicta* (Koshantschikov, 1923)
- ***caucasica*** Zagulajev, 1965

PERILICMETIS Meyrick, 1932*b*
diplaca Meyrick, 1932*b*

MOSCARDIA **gen. n.**
renitens (Meyrick, 1922*b*) **comb. n.**
varna **sp. n.**

GENTINGIA **gen. n.**
hollowayi **sp. n.**

SEMEOLONCHA Gozmány, 1968
penicillata Gozmány, 1968

CRANAODES Meyrick, 1919
stereopa Meyrick, 1919
oroya **sp. n.**
sequestrata Meyrick, 1926.

PECTINISCARDIA **gen. n.**
prostylias (Meyrick, 1927) **comb. n.**

HORMANTRIS Meyrick, 1927
astragalopa Meyrick, 1927

CNISMORECTIS Meyrick, 1936
choritica Meyrick, 1936

MINISCARDIA **gen. n.**
minimella (Busck, 1914) **comb. n.**
sp. A

NECROSCARDIA **gen. n.**
funeratella (Zeller, 1863) **comb. n.**
morticina **sp. n.**

TINISSA Walker, 1864
Polymnestra Meyrick, 1927
polystacta (Meyrick, 1918)
perilithias (Meyrick, 1927)
cultellata (Gozmány & Vári, 1973)
yaloma Robinson, 1981
phrictodes Meyrick, 1910
philippinensis Robinson, 1976*a*
polysema Zagulajev, 1972
albipuncta Robinson, 1976*a*
insignis Zagulajev, 1972
eumetrota Meyrick, 1926
palmodes Meyrick, 1917
convoluta Robinson, 1976*a*
chalcites Robinson, 1976*a*
araucariae Robinson, 1976*a*
amboinensis Robinson, 1976*a*
cinerascens Meyrick, 1910
krakatoa Robinson, 1976*a*
distracta Meyrick, 1916
errantia Robinson, 1976*a*
torvella torvella Walker, 1864
torvella mysorensis Robinson, 1976*a*
classeyi Robinson, 1981
ruwenzorica Gozmány, 1966
spaniastra Meyrick, 1932
poliophasma Bradley, 1965
dohertyi Robinson, 1976*a*
transversella (Walker, 1864)
indica Robinson, 1976*a*
bakeri Robinson, 1976*a*
baliomicta Meyrick, 1928
rigida Meyrick, 1910
heterograpta Meyrick, 1928
chloroplocama Meyrick, 1938
parallela Robinson, 1976*a*
goliath Robinson, 1976*a*
kidukaroka Robinson, 1976*a*
insularia Robinson, 1976*a*
chaotica Robinson, 1976*a*

SCARDIELLA **gen. n.**
approximatella (Dietz, 1905) **comb. n.**

AFROSCARDIA **gen. n.**
capnochalca (Meyrick, 1932*b*) **comb. n.**

AMOROPHAGA Zagulajev, 1968
rosemariae **sp. n.**
cryptophori (Clarke, 1940) **comb. n.**
hyrcanica Zagulajev, 1968
japonica **sp. n.**

DIATAGA Walsingham, 1914
leptosceles Walsingham, 1914
frustraminis **sp. n.**
brasiliensis (Zagulajev, 1966) **comb. n.**
compsacma Meyrick, 1919
levidensis **sp. n.**
mercennaria **sp. n.**
direpta **sp. n.**

MOROPHAGA Herrich-Schäffer, 1853
Atabyria Snellen, 1884
Osphretica Meyrick, 1910
Microscardia Amsel, 1952

bucephala-group
cremnarcha (Meyrick, 1932*b*) **comb. n.**
nigrocapitella Petersen, 1959 **syn. n.**
bucephala (Snellen, 1884)
chomatias (Meyrick, 1910)
rotundata (Matsumura, 1931)
soror Gozmány, 1965
vadonella (Viette, 1954)

morellus-group
morellus (Duponchel, 1838)
fungicolella Dumont, 1930 **syn. n.**

sistrata-group
borneensis **sp. n.**
sistrata (Meyrick, 1916) **comb. n.**

***formosana* sp. n.**
***iriomotensis* sp. n.**

***clonodes*-group**
clonodes (Meyrick, 1893) **comb. n.**
porphyrea (Lower, 1903) **syn. n.**
maculosa (Diakonoff, 1949) **syn. n.**

***choragella*-group**
choragella ([Denis & Schiffermüller], 1775)
boleti (F., 1777)
fungella (Thunberg, 1794)
mediella (Hübner, 1796)
hyrcanella Zagulajev, 1966
talyshensis Zagulajev, 1966
***fasciculata* sp. n.**
***kobella* sp. n.**

Taxa incertae sedis

LEPTOZANCLA Meyrick, 1920
talaroscia Meyrick, 1920

PHILAGRIAS Meyrick, 1932 **gen. rev.**
zelotica (Meyrick, 1932) **comb. rev.**

SCARDIA s.l.
tholerodes Meyrick, 1894
pharetrodes Meyrick, 1934
isthmiella Busck, 1914

Taxa excluded from the Scardiinae

Morophaga angulatella Walsingham, 1897: 168. Transferred to *Acrolophus* Poey (Tineidae: Acrolophinae) **comb. n.**

Morophaga hirsutevestita Walsingham, 1897: 167. Transferred to *Acrolophus* Poey (Tineidae: Acrolophinae) **comb. n.**

Scardia conglomerata Meyrick, 1922*a*: 12. Transferred to *Paraclystis* Meyrick (Tineidae: Tineinae) **comb. n.**

Scardia lochaea Meyrick, 1911: 307. Transferred tentatively to *Afrocelestis* Gozmány (Tineidae: Meessiinae) **comb. n.**

Scardia saccharata Meyrick, 1914: 205. Transferred to *Narycia* Stephens s.l. (Psychidae) **comb. n.**

Classification and characters – but phylogeny?

Objectives

The object of this section is to derive a phylogenetic classification of the Scardiinae. Alternatives to the now widely-used 'Hennigian' phylogenetic classifications are those derived by phenetic methods. Arguments for and against different procedures of classification are rife and the reader is referred to the plethora of recent textbooks and papers on the subject for further enlightenment.

It was obvious by inspection that considerable homoplasy occurred within the Scardiinae and within the data matrix compiled for this exercise (Table 1). No 'hand-made' phylogeny could be derived. Techniques for measuring the degree of homoplasy and assessing character 'robustness' were therefore used to pinpoint 'reliable' characters and to clean up the data matrix by removing characters that exhibited high levels of homoplasy. Both phenetic and cladistic methods were employed, to gain familiarity with and to evaluate the techniques, and to contrast the results and assess the degree of consensus between them.

Methods

Character compatibility and homoplasy

The more characters in a matrix of character-scores that are mutually compatible, the more easily may a minimum-length rooted or unrooted tree be resolved. By current convention the minimum-length rooted tree is adopted as the hypothesis of phylogeny of a group. The most parsimonious tree (that with fewest steps) will be shorter and have a greater probability of being unique the greater the degree of character compatibility within the matrix.

Le Quesne (1969; 1972; 1979) has shown the incompatibility of a pair of binary-state characters to involve the presence of all four possible combinations of character-states. This test for incompatibility has become known colloquially as Le Quesne's test. Character incompatibil-

Table 1 Character matrix for Scardiinae: 26 OTUs and 54 characters.

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DATA MATRIX
TAXON  1 : 111100000100000000011000001000000000000110111100000000 APOMORPHIES: 14
TAXON  2 : 111100000100000000111010001101100001010100000100000000 APOMORPHIES: 17
TAXON  3 : 111100000100000000011010001100000011010100110011000000 APOMORPHIES: 18
TAXON  4 : 111100000100001000111010000000000000000000000000000000 APOMORPHIES: 10
TAXON  5 : 111100001100010000111010000101000000000100110111001000 APOMORPHIES: 20
TAXON  6 : 111100000100010000011010100000000000000000000111001000 APOMORPHIES: 14
TAXON  7 : 111100000100000010111011111000000001010110110110010000 APOMORPHIES: 23
TAXON  8 : 111100001100001000011000110100000001111110100111001000 APOMORPHIES: 23
TAXON  9 : 101011000010000001000000000000100010000001000000000000 APOMORPHIES: 9
TAXON 10 : 100010000001000111101000001000011001110100010111001010 APOMORPHIES: 21
TAXON 11 : 100011000001000111001000001000011001110110111001010 APOMORPHIES: 23
TAXON 12 : 101011000001001010000001110000000000000001000000000010 APOMORPHIES: 12
TAXON 13 : 110100000001000011001101100100000001111100110111001010 APOMORPHIES: 23
TAXON 14 : 110111000001010011001101100100000001011110110111000010 APOMORPHIES: 25
TAXON 15 : 101000000000100111100000001100000000101011011011111101110 APOMORPHIES: 22
TAXON 16 : 000100000000000010100101101000000001011000010010000000 APOMORPHIES: 12
TAXON 17 : 000100000000010010001100100110000001000100000011000000 APOMORPHIES: 12
TAXON 18 : 001100000000010010001100110110000001000110000011000000 APOMORPHIES: 15
TAXON 19 : 001000000000010010110000000000100000000000000000000000 APOMORPHIES: 6
TAXON 20 : 001101000000010001111000001000100000000010000000010000 APOMORPHIES: 12
TAXON 21 : 001000000000010001001000000000100000010110110011000111 APOMORPHIES: 15
TAXON 22 : 000001000010010000100101000100000011000100010111000010 APOMORPHIES: 15
TAXON 23 : 100011000010000011000000001000011001000100010111000010 APOMORPHIES: 16
TAXON 24 : 111111110000010000000000100100010111111110111011110111 APOMORPHIES: 30
TAXON 25 : 101000110000010000000000000000010101111100111011110111 APOMORPHIES: 22
TAXON 26 : 101011000100100011000100100000000101110100110100000110 APOMORPHIES: 20
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ity (= Le Quesne test failure) is due to homoplasy, itself the result either of character reversal or convergence. Gauld & Mound (1982) have discussed the high frequency of Le Quesne test failure found in data from some insect groups and found it to be concordant with difficulties encountered in classification at generic level in those groups.

Le Quesne's test as conceived originally (1969; 1972) is independent of any definition of character-state polarity; i.e., it is not necessary to define or know which state is the primitive (plesiomorphic) and which the derived (apomorphic) before performing the test. However, a corollary to the test must be that, in cases in which polarity *is* defined, the occurrence of only three of the four possible combinations when the missing fourth combination is that of the two plesiomorphic states (00) must also be grounds for failure (Le Quesne, 1979; Gauld, pers. comm.).

Le Quesne (1972) has described a series of methods for the selection of mutually compatible characters. He has embodied his methods I–IV in a program (for the Commodore 64 microcomputer) and I am most grateful to him for providing this and other programs for use in investigating the properties of the Scardiinae data set. The methods are designed to yield a suite of mutually compatible characters (cliques) by progressive elimination of those characters with the highest frequency of Le Quesne test failure (I), by selection of those characters compatible with that having the lowest rate of failure (II), by selection of those characters compatible with that having the lowest coefficient of character-state randomness (CCSR – see below) (III), and by selection of those characters compatible with that having the lowest value of normal deviate (see Le Quesne, 1972) (IV).

Lack of certainty as to the polarity of certain character-states within the Scardiinae makes it appropriate to adopt in the first instance the uncritical version of Le Quesne's test that assumes unspecified character-polarity. It is this version that is used in Le Quesne's own program. However, combining this test with the more critical test in which failure requires the pairwise comparison to give only the 01, 10 and 11 combinations may point up those characters that are, by comparison with all others, most probably allotted the wrong polarity. Thus in a table of Le Quesne test comparisons (e.g., Gauld & Mound, 1982) failure may be denoted by an 'X', a pass by '—' and failure that is consequent upon a '00' pairing in a hypothetical taxon by a '*'. A character that exhibits a large number of '*'s in the table has probably had the polarity of its

constituent states assessed wrongly. Once this check has been made, the version of Le Quesne's test that assumes defined character-polarity is the appropriate one to use.

In addition, therefore, to Le Quesne's program utilizing his clique-indicating methods I–IV, a further program was developed which makes this comparison and draws the table. The program performs two further kinds of tests. The value of P (the probability of Le Quesne test failure by a pair of characters assuming random distribution of the character-states among the species) is calculated using the modified formula of Le Quesne (1979) and used to derive the coefficient of character-state randomness (CCSR) (Le Quesne, 1972). This is the ratio (expressed as a percentage) of the observed frequency of Le Quesne test failure to the expected frequency (from summation of P) – i.e., the proportion of test failures that would occur if the character-states were distributed at random among the species. It is a measure of the 'robustness' of a character. Characters exhibiting little homoplasy have a low CCSR; those with a high level of homoplasy have a high CCSR. This measure may be used to provide a weight for each character: the reciprocal of the observed/expected ratio has been utilized for this purpose in weighted centroid cluster analysis. The program provides also, for each character, a list of the other characters that are compatible with it and with each other: this list of cliques of wholly-compatible characters may be used to find, by inspection, the largest clique or cliques. The method is complementary to Le Quesne's clique-indicating methods I–IV.

The individual test failures of pairs of characters may be examined individually to ascertain those character-scores for particular taxa that contribute most to the overall homoplasy of the data set. Pairs of characters that fail the test are examined in turn: if a single combination of '01', '10' or '11' occurs, the taxon responsible for the single failure-causing score is allocated one 'hit' for each character on a taxa × characters matrix. This procedure is repeated for each character-combination that fails the Le Quesne test. The resulting table resembles the original data matrix but the individual character-scores are replaced by the total 'hits' for which each character-score was responsible. This technique pinpoints, by high numbers of 'hits', wrongly coded data and unique instances of homoplasy. Some falsehoods occur, however; the scores of character-states that occur in only two taxa tend to attract 'hits'. This is because Le Quesne test failure of characters with such a distribution of states must involve each member of the pair of states (say, '1') forming a different combination (thus, '1–0' and '1–1') with the states of the opposed character in order for the test to fail. Both combinations, being unique within the test, attract a 'hit'. Comparison of the sums of the 'hit' scores for the taxa will indicate those taxa in which homoplasy is concentrated.

Clustering and tree-building

Camin-Sokal trees are rooted cladograms constructed on the assumption that a descendent character-state cannot revert to an ancestral character-state – i.e., that homoplasy is always the result of convergence. By contrast, in the construction of a rooted or unrooted Wagner tree either convergence or reversal may be invoked (whichever is the more parsimonious – i.e., requiring fewer steps) to account for the distribution of character-states among taxa (Sneath & Sokal, 1973). Camin-Sokal trees were derived using I. M. White's 'Hennig' program adapted for the Commodore 64. Wagner trees, optimized by branch swapping and the testing of all possible trees for up to nine OTUs, were constructed using a suite of programs written by W. J. Le Quesne. At the very end of the project, Swofford's sophisticated mainframe program 'PAUP' was utilized, employing options for multiple parsimony and optimization by global branch-swapping.

Five methods of cluster analysis have been used to generate dendrograms as alternatives to cladistic analysis using Wagner and Camin-Sokal techniques. Three of these methods utilized a common matrix of Gower similarity coefficients to yield dendrograms by, respectively, single-link, complete link and average-link cluster-analysis. Analysis was performed using programs provided by W. J. Le Quesne. The fourth and fifth methods were, respectively, weighted and unweighted centroid cluster analysis using the technique described by Robinson (1975) but modified for binary-state data. Characters were each weighted by the reciprocal of their ratio of observed to expected Le Quesne test failure as described above.

Supraspecific groups (OTUs) classified

Twenty-six groups (OTUs) were subjected to numerical analysis. Twenty-one of these are groups represented in the subsequent taxonomic treatment as either genera or species-groups: the remaining five OTUs are the two species of *Moscardia*, *Morophaga borneensis*, and the Old World and New World species of *Morophagoides*. Each taxon was allocated an identifying number, as follows.

1: *Morophaga bucephala*-group
2: *Morophaga borneensis*
3: *Morophaga morellus*-group (monobasic)
4: *Morophaga choragella*-group
5: *Morophaga sistrata*-group
6: *Morophaga clonodes*-group (monobasic)
7: *Amorophaga*
8: *Diataga*
9: *Miniscardia*
10: *Moscardia renitens*
11: *Moscardia varna*
12: *Necroscardia*
13: *Scardia*
14: *Daviscardia*
15: *Cranaodes*
16: *Montescardia*
17: *Morophagoides* (old World species)
18: *Morophagoides* (new World species)
19: *Scardiella* (monobasic)
20: *Afroscardia* (monobasic)
21: *Pectiniscardia* (monobasic)
22: *Bythocrates* (monobasic)
23: *Perilicmetis* (monobasic)
24: *Cnismorectis* (monobasic)
25: *Hormantris* (monobasic)
26: *Gentingia* (monobasic)

The identifying number for each taxon is the same throughout all analyses and is that used in Table 1. *Semeoloncha* has been omitted from phenetic and cladistic assessment. The two specimens are in poor condition and, in both, most of the abdomen has been discarded during the preparation of the genitalia slide. As a result, the set of character scores for *Semeoloncha* is so incomplete as to render analysis impossible. *Tinissa* has also been omitted: a cladistic classification of this undoubtedly monophyletic group has already been proposed (Robinson, 1981) and the marked homoplasy within the genus makes its scoring particularly difficult. It is placed here as the sister-group of *Necroscardia*, sharing with that genus an extraordinarily modified juxta (Robinson, 1976*a*; 1981).

Characters used in classification

Extraordinary conservatism in the external structure of Scardiinae contrasts sharply with the morphological diversity of the genitalia which is just as remarkable as that described previously for *Tinissa* (Robinson, 1976*a*). Characters were selected for inclusion that were stable within genera or species-groups defined on the basis of close similarity in genital structure. Two distinct groups of characters were used. The first group (characters 1–30; 50–54) includes 'conventional' characters of the head, legs, wings and genitalia (including modification of the terminal abdominal segment). Genital characters were restricted to those of males (with the exception of 29, a synapomorphy of all *Morophagoides* species) as the inclusion of characters of the female genitalia would have reduced substantially the number of taxa upon which analyses could be performed. Thirty-five binary-state 'conventional' characters were selected for inclusion in the analyses.

In addition to the thirty-five 'conventional' characters, it was found that the number and disposition of sensory setae on the ventral surface of the abdomen, visible under phase contrast at a magnification of ×150 or ×250, provided a second group of 'unconventional' characters that were of use in classification at generic and subgeneric level. Accordingly, a further 19 binary-state characters (31–49) were added to the matrix of character-scores (Table 1).

The arrangement of setae on the abdominal sternites follows a basic plan. A cluster of setae (more than 30 in most Scardiinae) occupies a medial position close to the posterior margin of sternite 2. Sternites 3 to 7 each carry a pair of widely separated setae close to the anterior margin. The region between these 'fixed' setae may, in some taxa, contain an arc of irregularly-placed accessory setae: their presence or absence and their concentration (although not their precise number) on a particular sternite appears to be reasonably consistent at species-group level.

Accessory setae are present on sternite 7 in all Scardiinae. Sternite 8 does not possess the 'fixed' pair in all taxa but, in most taxa, accessory setae are present, scattered close to the anterior margin. *Amorophaga* does not possess the 'fixed pair' and only a single pair of accessory setae is present. These, from their position, do not represent the 'fixed pair'.

Setae are frequently lost during the process of cleaning the abdomen. However, the sockets of sensory setae are easily distinguished from the surrounding scale-bases when viewed under phase-contrast and can be counted.

Character-polarities were estimated initially by outgroup comparison with other subfamilies of Tineidae, notably the Nemapogoninae, Myrmecozelinae (including *Hapsifera*), Tineinae and Hieroxestinae. Inappropriate comparisons or those yielding ambiguous results were reinforced by in-group comparisons in the light of preliminary classifications made using phenetic and Camin-Sokal methods. Further refinements to polarity estimation were made in the light of character-compatibility analysis using Le Quesne's test and its derivatives.

In the absence of detailed information from other groups, the polarities of setal characters are inevitably tentative.

The characters used in classification are as follows. The presumed apomorphic state is described first, and the plesiomorphic state second. Some comments on the characters, their variation, occurrence, and significance are included. A measure of the homoplasy of each character (the coefficient of character-state randomness – CCSR) is given. The 14 characters that survive one or more of Le Quesne's elimination procedures (Le Quesne, 1972) are indicated.

1: Antenna of male lacking cilia from the dorsal surface/cilia developed on the whole circumference of each flagellar segment. The states of this character are clear-cut and the arrangement of cilia is easily visible under low magnification if the specimen is rotated along the axis of the flagellum. CCSR = 68%.

2: Antenna of male lacking scales on the ventral surface of the flagellum/complete circumference of each flagellar segment scaled. The states of this character are not as clear-cut as those of the preceding character, nor as easy to observe. Some loss of scales seems to occur naturally in worn specimens; however, the apomorphic state of this character is usually recognizable as at least a narrow bare line on the undersurface of the flagellum. In some groups it is very obvious, and in *Scardia* the bare ventral area accommodates a distinct swelling of each segment (see Zagulajev, 1973: figs 5, 6). CCSR = 81%.

3: Antennal cilia of male longer than 1·5× the flagellar diameter/cilia shorter than 1·5× the flagellar diameter. In practice, this division is realistic although occasional 'borderline cases' have been noted at individual level. Both states have, however, been noted in different species of *Daviscardia*: the plesiomorphic state has been entered in the data matrix for that genus. CCSR = 68%. Survives Le Quesne elimination procedure 4.

4: Antennal pecten with more than 15 bristles/pecten with fewer than 15 bristles. This character has been discussed previously with respect to *Tinissa* (Robinson, 1981). The difference between the typical tineid pecten with sparse and slender bristles and the apomorphic 'brush' of sometimes more than 40 flattened bristles present in some Scardiinae is obvious in fresh specimens. However, the pecten is subject to rapid attrition during life and the confirmation of the plesiomorphic state usually requires preparation of the antenna for microscopic examination in transmitted light. Pectens with large numbers of bristles do occur in a few other scattered genera in the Tineidae. For example, *Dasyses* (Hapsiferinae) has a pecten of about 30 filamentous bristles but these are so thin that the pecten never appears brush-like as in the Scardiinae. CCSR = 85%.

5: Interocular index greater than 1·0/interocular index equal to or less than 1·0. This index is the vertical diameter of the eye divided by the interocular distance as measured at about the level of the tentorial pits. Although the measurement is best made on a microscopic preparation of the head, the paucity of specimens of most groups necessitated its being taken from pinned specimens in this study. The range observed in the Scardiinae is narrow – from about 0·7 to 1·3 –

and continuous; it is unlikely that this character is of value for classification in this group. CCSR = 92%.

6: Maxillary palpus with fewer than five segments (usually three, occasionally four segments: palpus usually short, only reaching the base of the second segment of the labial palpus/maxillary palpus 5-segmented (usually elongate, reaching the apex of the second segment of the labial palpus). Resolution of the segmentation of the maxillary palpus is difficult without preparation of the head for examination in transmitted light. This has not been possible for many groups and the character-scores given here should be treated with some caution. Only a single example of an elongate three-segmented palpus has been noted – in one species of *Daviscardia*; however, in *Montescardia* the maxillary palpus, although five-segmented, is as short as in most groups with a three-segmented palpus (Zagulajev, 1973: fig. 4). CCSR = 93%.

7: Pilifers absent/pilifers present. CCSR = 23%. Survives Le Quesne elimination procedures 1–4.

8: Second segment of labial palpus exceptionally slender and elongate, longer than width of head/second segment shorter than width of head (see 54). CCSR = 23%. Survives Le Quesne elimination procedures 1–4.

9: Outer mid-tibial spur and outer proximal hind tibial spur short, less than 0·4 the length of the corresponding inner spur/outer spurs of normal length, about 0·5–0·7 the length of the inner spurs. While consistent and conspicuous, the significance of this character is uncertain. Short spurs are found in *Diataga*, the *Morophaga sistrata*-group and in *Morophaga fasciculata*. CCSR = 37%. Survives Le Quesne elimination procedure 2.

10: Forewing veins R_3 and R_4 fused, stalked or approximated at base (connate)/R_3 and R_4 separate. This character is subject to some intraspecific variation and both stalking and basal approximation of the two veins may occur in the same species. However, fusion is a rare individual variation. CCSR = 73%.

11: Forewing veins M_3 and CuA_1 stalked or approximated at base (connate)/M_3 and CuA_1 separate. Some individual variation occurs in this character: fusion has not been noted. The stalking of M_2 and M_3 is an autapomorphy of *Diataga*. CCSR = 58%.

12: Forewing pattern composed of dark purple-brown ground-colour with contrasting whitish terminal and posterior fasciae (continuous in many taxa)/forewing pattern irrorate and cryptic, resembling moss or speckled tree-bark, or otherwise modified. The state of this character has been scored as apomorphic for *Moscardia renitens* but is uncertain in this species as the only known specimen is very worn. Several of the New World species of *Morophagoides* and *Cranaodes oroya* have wing-patterns that approach the apomorphic state of this character but these are considered to be cases of convergence. CCSR = 71%.

13: Forewing pattern composed of light greenish bronze ground-colour with bold purple-brown marginal spots/forewing pattern irrorate and cryptic, resembling moss or speckled tree-bark, or otherwise modified (see 12). The apomorphic state of this character is shared by *Semeoloncha* as well as *Cranaodes* (highly modified in *oroya*) and *Gentingia*. The somewhat similar, strongly-marked pattern of certain species of *Morophagoides* (notably *iulina*) is considered to be a convergent development: it is not strictly comparable as the dark blotches are not at or arising from the wing margin. CCSR = 45%. Survives Le Quesne elimination procedures 1–4.

14: Coremata absent from eighth abdominal segment/pair of lateral coremata present in eighth abdominal segment. This character was found to be highly unstable in *Tinissa* (Robinson, 1981) and a similar high level of homoplasy seems to occur in the remainder of the Scardiinae. CCSR = 87%.

15: Pair of elongate and tubular apodemes arising from sides of eighth sternite and associated with coremata/eighth sternite without apodemes or with flap-like apodemes arising from posterior corners. CCSR = 73%.

16: Pair of short, flap-like apodemes arising from posterior corners of eighth sternite and associated with coremata/eighth sternite without apodemes or with elongate rod-like apodemes arising from sides. The apomorphic state of this character is expressed in *Semeoloncha* (not included in analyses) as well as in both species of *Moscardia* and in *Cranaodes*. CCSR = 38%.

17: Uncus complex, modified usually by strong sclerotization and the development of spines or more elaborate processes/uncus simple, a pair of soft and setose lobes. CCSR = 79%.
18: Uncus lobes fused with tegumen/uncus lobes separated from tegumen by at least a narrow and recognizable line of flexion. CCSR = 80%.
19: Tegumen broken mid-dorsally by at least a narrow membranous suture-line/tegumen fused dorsally and thus complete. CCSR = 90%.
20: Valva with setose lobe arising from internal membrane close to base of costa and frequently associated (most markedly in *Diataga*) with a strongly developed transtilla/valva lacking basal setose lobe. The occurrence of an internal lobe in *Scardiella* and *Afroscardia* is considered to be a convergent development unrelated to the occurrence of a similar lobe in *Morophaga*, *Diataga* and *Amorophaga*. CCSR = 64%. Survives Le Quesne elimination procedures 1, 2 and 4.
21: Valva with ventroapical processes (or with apex modified) forming a functional hook/apex of valva smoothly rounded and/or incapable of use as a hook. CCSR = 84%.
22: Valvae fused ventrally to form a single movable complex/valvae separate, each capable of at least some independent movement. In the case of, for example, *Scardia*, fusion of the valvae involves also the juxta which is interposed between them: cases such as this have been interpreted as being the apomorphic state of the character. CCSR = 72%.
23: Valva with deep longitudinal cleft effectively dividing valva into dorsal and ventral arms/valva entire. The apomorphic state of this character is distinctive. It occurs in all species of *Amorophaga*, and in all species of *Morophaga* except the *bucephala*-group; however, the cleft is ill-defined and shallow in *Morophaga morella*. The emarginate dorsoapical region of the valva in the *bucephala*-group may in fact be a very shallow cleft but has not been scored as such. CCSR = 49%. Survives Le Quesne elimination procedures 1, 3 and 4.
24: Saccus broad, wider than long/saccus elongate, longer than wide. CCSR = 80%.
25: Juxta complex, bearing or forming processes, in some groups partially fused with and forming a functional part of the valvae, or apparently entirely fused with the valvae (e.g., some species of *Daviscardia*)/juxta simple, an ovate and usually ill-defined sclerite on the ventral surface of the anellus. CCSR = 89%.
26: Juxta divided medially into two arms or lobes/juxta entire. CCSR = 82%.
27: Vesica lacking spicular cornuti/vesica with spicular cornuti. Spicular cornuti are conspicuously developed in *Daviscardia*. In some other groups they are very small and sparse and should not be confused with the microtrichia lining the ductus ejaculatorius of all Tineidae. In some taxa the cornuti are minute, resembling microtrichia and probably of similar structure. There is, however, a clear demarcation between the vesica and the ductus ejaculatorius in all specimens examined. CCSR = 86%.
28: Aedeagus smooth-surfaced/aedeagus with spinose carinae. The homology of, for example, the minute spicular carinae of *Daviscardia luctuosa* with the comparatively enormous carinae of *Moscardia* is uncertain. CCSR = 91%.
29: Female with pair of strong pocket-shaped signa in bursa copulatrix/bursa copulatrix either without signa or signa not of this form. The apomorphic state of this character is a synapomorphy of all *Morophagoides* species. CCSR = 8%. Survives Le Quesne elimination procedures 1–4.
30: Apices of otherwise simple pair of uncus lobes fused together and tapered to form a minute hook/apices of uncus lobes not so modified. The apomorphic state of this character is a synapomorphy for the *Morophaga sistrata*-group. CCSR = 31%. Survives Le Quesne elimination procedures 1, 3 and 4.
31: Medial group of setae on sternite 2 with fewer than 15 pairs/medial group with more than 15 pairs of setae. CCSR = 71%.
32: Longitudinal line of microtrichia present, running through medial group of setae on sternite 2/microtrichia absent. CCSR = 66%.
33: Microtrichia minute, requiring magnification of ×600 and phase-contrast for definition/microtrichia comparatively large, visible at ×150. CCSR = 28%. Survives Le Quesne elimination procedures 1–4.

34: Medial group of setae broad, scattered across more than 0·4 width of sternite/medial group compact, less than 0·4 width of sternite. CCSR = 58%.
35: Medial group with isolated outlying pair of setae/medial group uniformly spaced. CCSR = 98%.
36: Sternite 3 with accessory setae present/accessory setae absent. CCSR = 79%.
37: Sternite 3 with more than 4 pairs of accessory setae/fewer than 4 pairs of accessory setae. CCSR = 82%.
38: Sternite 4 with accessory setae present/accessory setae absent. CCSR = 77%.
39: Sternite 4 with 3 or more pairs of accessory setae/fewer than 3 pairs of accessory setae. CCSR = 82%.
40: Sternite 5 with accessory setae present/accessory setae absent. CCSR = 70%.
41: Sternite 5 with 3 or more pairs of accessory setae/fewer than 3 pairs of accessory setae. CCSR = 97%.
42: Sternite 6 with accessory setae absent/with accessory setae present. CCSR = 51%. Survives Le Quesne elimination procedure 3.
43: Sternite 6 with 3 or more pairs of accessory setae/fewer than 3 pairs of accessory setae. CCSR = 77%.
44: Sternite 7 with 3 or more pairs of accessory setae/fewer than 3 pairs of accessory setae. CCSR = 76%.
45: Sternite 7 with 10 or more pairs of accessory setae/with fewer than 10 accessory setae. CCSR = 68%
46: Sternite 8 lacking 'fixed pair' of setae/'fixed pair' present. CCSR = 81%.
47: Sternite 8 with accessory setae present/accessory setae absent. CCSR = 80%.
48: Sternite 8 with more than one pair of accessory setae/one pair or no accessory setae present. CCSR = 80%.
49: Sternite 8 with 10 or more pairs of accessory setae/with fewer than 10 pairs of accessory setae. CCSR = 61%.
50: Sockets of ventral abdominal scales scattered randomly/sockets arranged in irregular transverse pattern. CCSR = 91%.
51: Sockets of ventral abdominal scales arranged in regular and strongly linear transverse pattern/sockets arranged in irregular transverse pattern. CCSR = 74%.
52: Ground-colour of forewing gold or pale bronze/ground-colour not thus, usually cream or off-white (but dark brown in *Afroscardia*). CCSR = 64%. Survives Le Quesne elimination procedures 1–4.
53: Scales of second segment of labial palpus short, giving the segment a cylindrical appearance/scales elongate, particularly distally, giving the segment a triangular appearance in lateral view. CCSR = 71%. Survives Le Quesne elimination procedures 1 and 2.
54: Labial palpus slender, longer than 0·9 the width of the head/labial palpus shorter and stouter, of typical tineid length. The apomorphic state of this character is expressed by *Cnismorectis*, *Hormantris* and *Pectiniscardia* but is not as pronounced in the latter species as in the other two. The extreme length of the palpus shared by these two is scored as character 8. CCSR = 51%. Survives Le Quesne elimination procedures 1–4.

Results

Investigation of homoplasy
Of the 2862 possible combinations of pairs of characters in the data set for the Scardiinae (Table 1), 1772 (61·9%) fail the critical version of Le Quesne's test. The number of test failures expected if scores were randomly distributed is 2495 and the overall coefficient of character-state randomness is thus 71%, indicating overall a high degree of homoplasy. Homoplasy appears to be spread throughout the data: only 14 of the 54 characters survived one or more of Le Quesne's elimination procedures (see above). Cliques of entirely compatible characters are smaller: two cliques of 10 characters, five cliques of nine, and larger numbers of smaller cliques were found. The seven largest cliques include 25 different characters. Only one of the characters that

survived Le Quesne's elimination procedures (23) is not included among them. These cliques of characters are too small to provide an adequate classification.

Only three characters exhibited Le Quesne test failures consequent upon a '00' pairing in a hypothetical taxon. These were characters 3 (two occurrences), 36 and 47 (one occurrence each).

'Hits' of particular scores for particular OTUs were not markedly concentrated in particular characters: totalled hits per character ranged from six (characters 3 and 29) to 37 (character 35), 43 characters attracting between 10 and 24 hits. The distribution of total hits among OTUs was much more erratic, however, ranging from two (OTU 14) to 110 (OTU 24). Five OTUs attracted 72 or more hits: these were *Diataga*, *Necroscardia*, *Cranaodes*, *Cnismorectis* and *Gentingia*. The remaining OTUs attracted 58 or fewer hits, seven attracting 10 or less. This observation suggests that certain OTUs may be 'reservoirs of homoplasy' and that their position within a classification should be treated with appropriate caution.

Nineteen individual character-scores (all apomorphic occurrences) attracted 10 or more hits. These were: OTU 1 – character 45; OTU 2 – character 30; OTU 5 – characters 9 and 30; OTU 8 – characters 9 and 15; OTU 9 – character 11; OTU 12 – characters 12, 15 and 26; OTU 15 – characters 13, 16 and 49; OTU 20 – character 50; OTU 21 – character 54; OTU 24 – character 35; OTU 26 – characters 10, 13 and 34. Characters 9, 13 and 30 have only a pair of apomorphic occurrences among the OTUs and their attraction of large numbers of hits may be artefactual (see above) or might suggest that the occurrences are the result of convergence. The latter explanation is unconvincing in the case of character 30 (the fusion and hooking of the apex of the uncus in the *Morophaga sistrata*-group and *M. borneensis*). However, the majority of the remaining scores attracting high numbers of hits would, by inspection and in the light of subsequent analyses, appear to be genuine instances of homoplasy.

The degree of homoplasy of the data set of the Scardiinae is such that attempts to define cliques of compatible characters, 'refine' the data set by removal of characters with high CCSRs or by deletion of obvious convergent occurrences of apomorphic scores resulted either in almost complete deletion of the matrix or in little improvement in the overall level of homoplasy. Accordingly, trees were prepared from the data set in Table 1 without modification, using the techniques described above.

Cladistic classification

The shortest cladogram found using a Camin-Sokal technique (no reversals permitted) involved 217 character-steps (Fig. 1); the shortest trees found originally using a Wagner method (convergence and reversal permitted) on a microcomputer involved 199 steps (Figs 2, 3). More sophisticated subsequent analysis using Swofford's PAUP program gave eight trees (rooted to an all-zero 'ancestor') of closely similar topology, each of 198 steps. The first tree is illustrated in Fig. 3a: the consensus tree of all eight variants is indicated by the dashed lines. Character changes on all branches are indicated; reversals (character-state changes from '1' to '0') are indicated by an asterisk. Topological variation within the eight 198-step trees involves interchange of *Morophaga borneensis* and *M. morellus*, interchange of *Morophagoides* and *Montescardia*, and interchange of four groups: *Scardia* + *Daviscardia*, *Gentingia*, *Moscardia* + *Perilicmetis*, and *Cnismorectis* + *Hormantris* + *Pectiniscardia* + *Cranaodes*.

The topology of the right-hand halves of the 199- and 198-step trees is the same. However, the sequencing of the left-hand halves differs considerably. The Camin-Sokal tree (Fig. 1) differs further from the 199- and 198-step optimized Wagner trees (Figs 2, 3, 3a). However, the species-groups of *Morophaga*, plus *Diataga* and *Amorophaga* together form a monophyletic group as they do in the Wagner trees (although interrelationships *within* the group differ). The two *Moscardia* species, *Scardia* + *Daviscardia*, *Cnismorectis* + *Hormantris* + *Pectiniscardia*, *Miniscardia* + *Necroscardia* and the two groups of *Morophagoides* species also form monophyletic groups as in the optimized Wagner trees. However, the sequence of branching to these groups is quite different in the Camin-Sokal tree.

The 198-step trees found by PAUP involve only seven uniquely derived characters (out of a

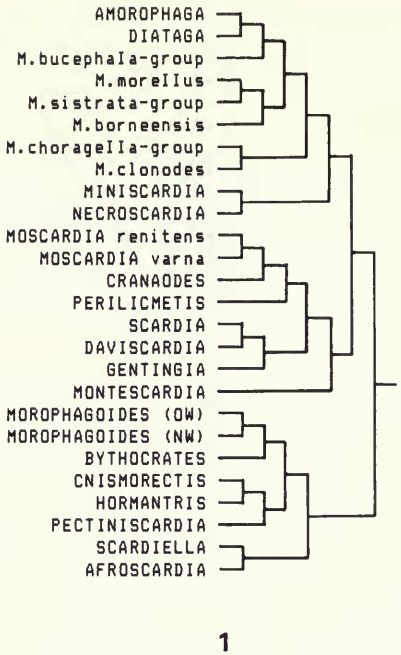
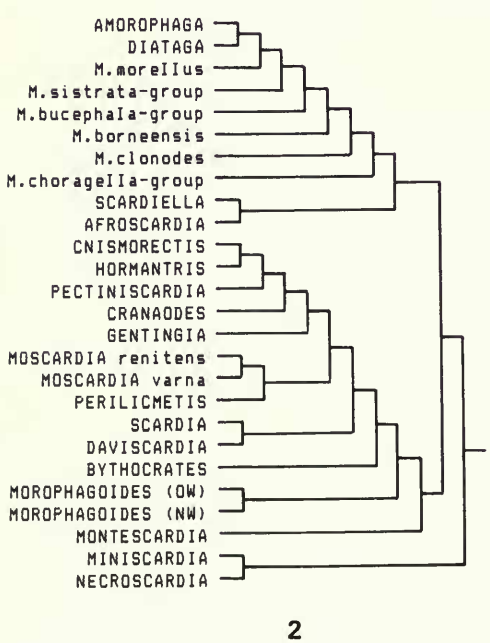
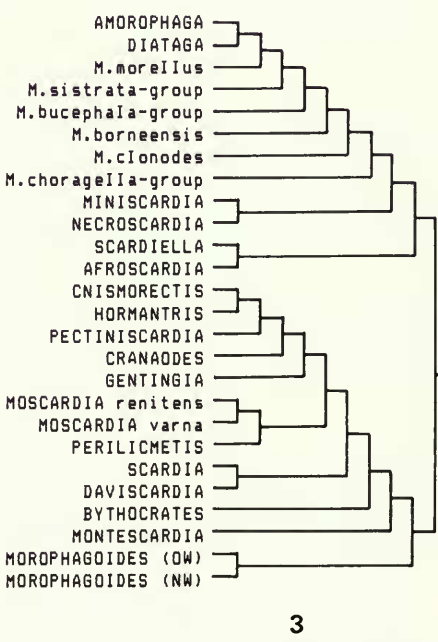


Fig. 1 Classification of Scardiinae by Camin-Sokal technique. This was the shortest tree found with 21 steps.





Figs 2, 3 Classification of Scardiinae by Wagner technique. Three alternative 199-step trees were found the third a variant of that in Fig. 3 with the *Miniscardia* + *Necroscardia* and *Scardiella* + *Afroscardia* branches transposed.

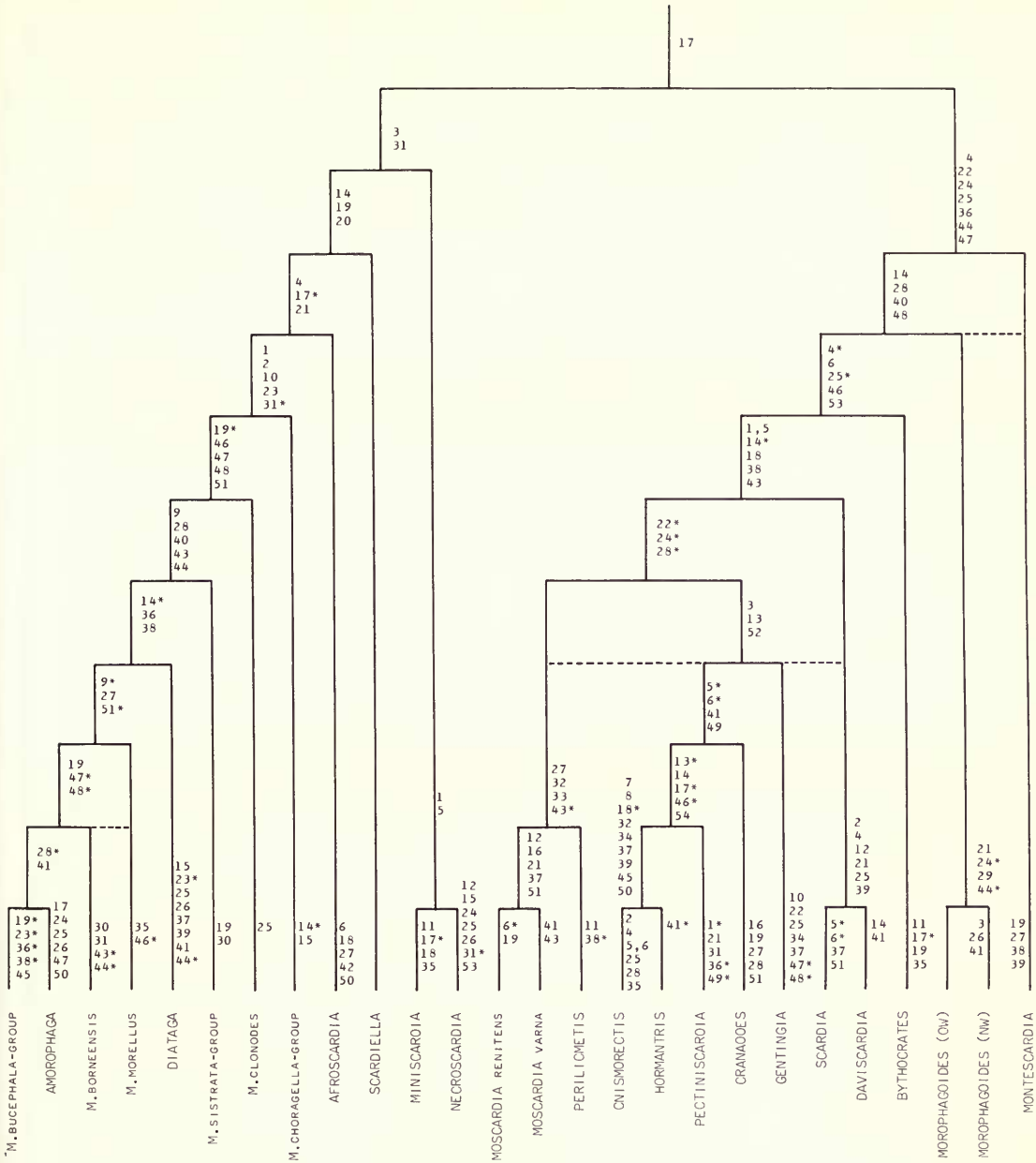


Fig. 3a Classification of Scardiinae by optimized Wagner tree generated by PAUP. The consensus tree for the eight 198-step trees obtained is indicated by dashed lines. Character changes on each branch are indicated; reversals are signified by an asterisk. There are no autapomorphic changes for *Scardiella* or *Morophagoides* (Old World spp.).

potential maximum clique of 10). These are 7, 8, 20, 29, 33, 52 and 54. All these were correctly predicted by Le Quesne elimination procedures. Characters 7 and 8 are synapomorphies of *Cnismorectis* and *Hormantris*; 20 (presence of valval lobe) is a synapomorphy of *Morophaga, Diataga*, *Amorophaga*, *Afroscardia* and *Scardiella*)but the lobe in the latter two genera may not be homologous with that in the others – see above); 29 is a synapomorphy of *Morophagoides*

species, 33 a synapomorphy of *Moscardia* + *Perilicmetis*; 52 is a synapomorphy of the branch *Cnismorectis* – *Gentingia* and 54 a synapomorphy of the group *Cnismorectis* + *Hormantris* + *Pectiniscardia*. Thirteen of the 19 character-scores that attracted 10 or more 'hits' (see above) are explained as single convergent occurrences in individual taxa. The remaining six involve changes to characters 9, 13 and 54. Character 54 is uniquely derived in the PAUP tree. Character 9 occurs in its apomorphic state in *Diataga* and the *Morophaga sistrata*-group; 13 occurs in its apomorphic state in *Cranaodes* and *Gentingia* and is accounted for in the PAUP analysis by a 'switch on – switch off' sequence as is character 9.

Characters undergo up to nine changes (characters 19 and 25) in the PAUP tree. The number of characters undergoing two to nine changes is, respectively, 11, 9, 8, 12, 3, 2 and 2. Characters surviving Le Quesne elimination procedures appear to be 'robust' on the PAUP tree. Seven of the 14 are uniquely derived (see above; characters 9, 13 and 23 are derived only once but undergo reversal once (9, 13) or twice (23). Characters 30, 42 and 53 are derived twice while character 3 is derived three times.

Phenetic classification

Trees were derived using single-link, complete-link and average-link cluster analysis (Figs 4, 5, 6) and by unweighted and weighted centroid cluster analysis (Figs 7, 8). Single-link clustering (Fig. 4) recovers the left half of the optimized Wagner tree produced by PAUP (Fig. 3a) as a discrete cluster but the sequence of linkage of its component OTUs is quite different. The groups *Moscardia* + *Perilicmetis*, *Cnismorectis* + *Hormantris*, *Morophagoides*, and *Scardia* + *Daviscardia* are also recovered. Complete-link clustering (Fig. 5) recovers *Morophaga* + *Diataga* + *Amorophaga* as a single cluster along with *Miniscardia* + *Necroscardia*, *Moscardia* + *Perilicmetis*, *Scardia* + *Daviscardia*, *Morophagoides*, and *Cnismorectis* + *Hormantris*. Average-link clustering (Fig. 6) additionally clusters *Pectiniscardia* with *Cnismorectis* + *Hormantris*. Centroid cluster analysis (Fig. 7) recovers only *Moscardia*, *Scardia* + *Daviscardia*, *Morophagoides*, and *Cnismorectis* + *Hormantris*: the technique is highly discriminatory and the result is somewhat at

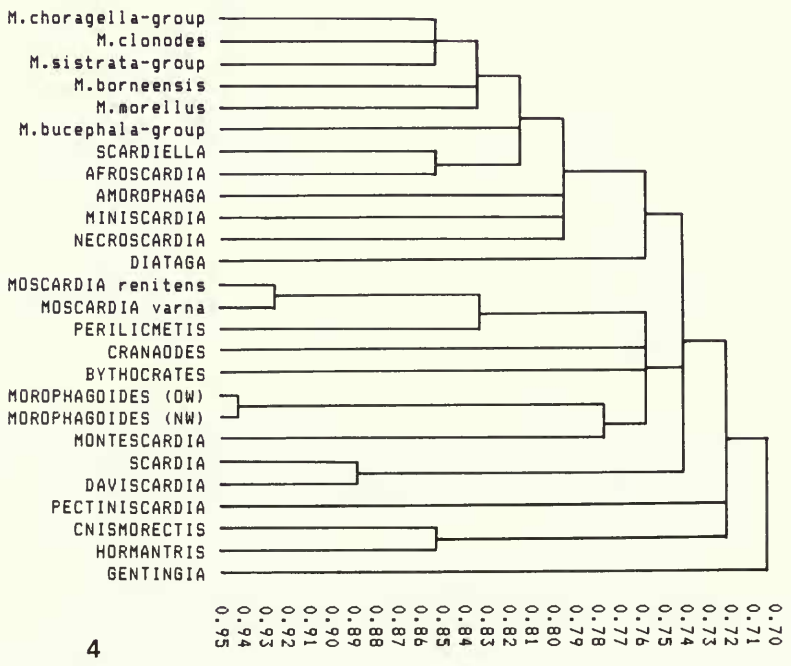


Fig. 4 Classification of Scardiinae by single-link cluster analysis.

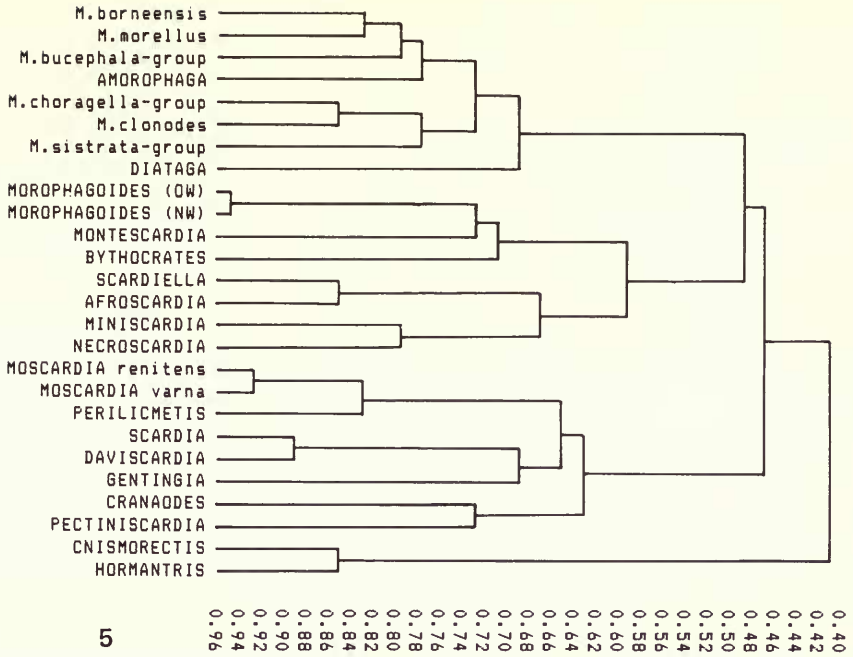


Fig. 5 Classification of Scardiinae by complete-link cluster analysis.

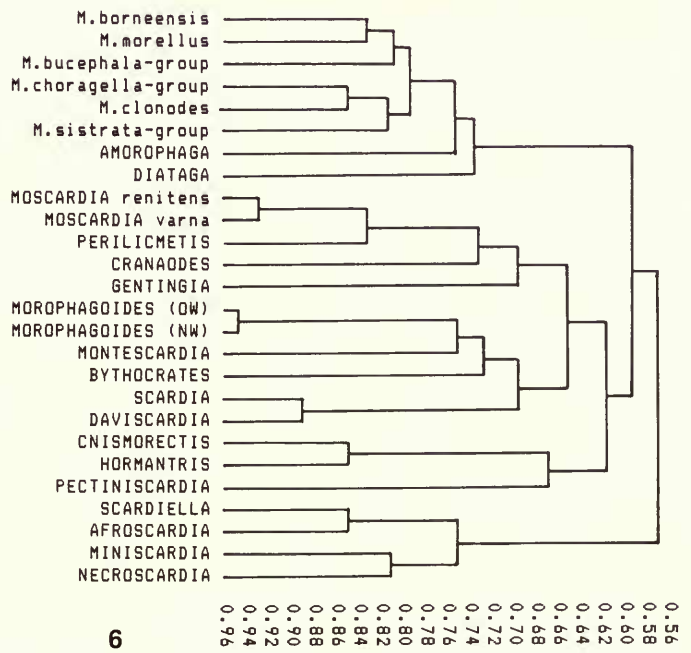


Fig. 6 Classification of Scardiinae by average-link cluster analysis.

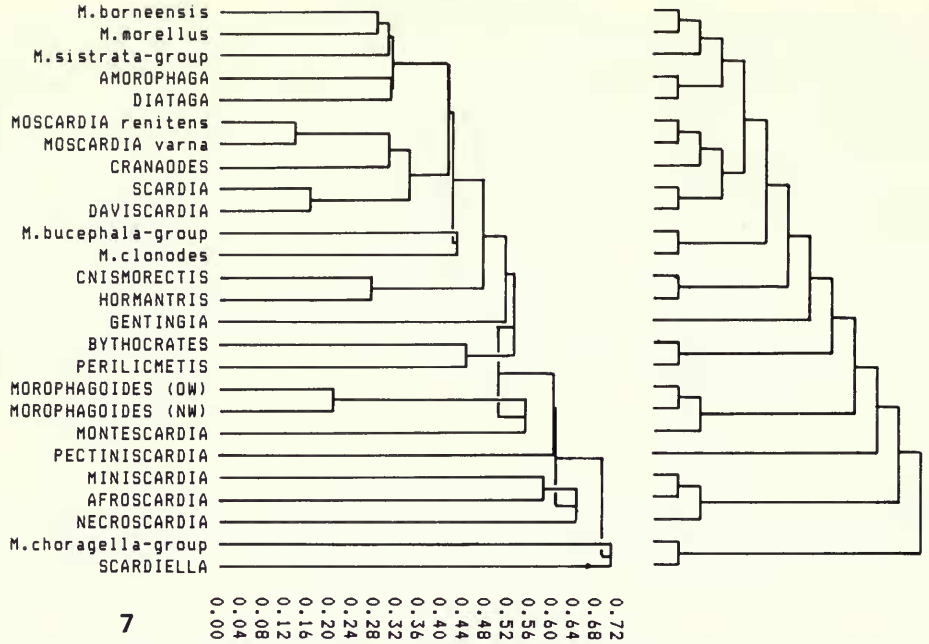


Fig. 7 Classification of Scardiinae by unweighted centroid cluster analysis: the linkage sequence is clarified on the right.

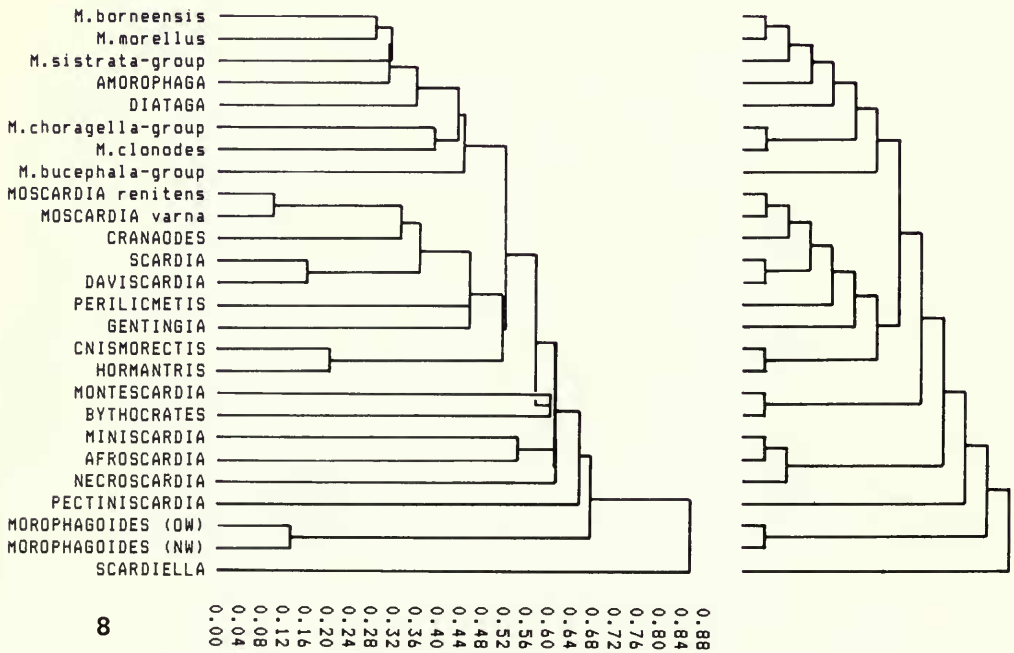


Fig. 8 Classification of Scardiinae by weighted centroid cluster analysis: the linkage sequence is clarified on the right.

variance with those obtained using other methods. Weighting the characters in centroid analysis (Fig. 8) permits recovery of a further group found by other methods – *Morophaga* + *Amorphaga* + *Diataga*.

Within *Morophaga, Diataga* and *Amorophaga*, certain OTUs are grouped consistently by the various phenetic methods. The *Morophaga choragella*-group and *M. clonodes* are paired by four of five methods; *M. borneensis* is paired with *M. morellus* by four of five methods. The *M. sistrata*-group is paired with the *M. choragella*-group + *M. clonodes* by three of five methods. None of these groups is supported by the PAUP tree but the Camin-Sokal tree also pairs the *M. choragella*-group and *M. clonodes*.

Classification adopted

The classification of the Scardiinae adopted here is a modified version of the 198-step tree shown in Fig. 3a. *Tinissa* is placed tentatively as the sister-group of *Necroscardia*, and *Semeoloncha* as the sister-group of *Cranaodes*. For the purposes of the present paper, *Amorophaga* and *Diataga* have been retained as separate genera, but it is probable that *Morophaga* is paraphyletic with respect to both. *Morophaga borneensis* is considered to be a member of the *M. sistrata*-group, sharing character 30 which is considered to be uniquely derived. Relationships of *Amorophaga*, *Diataga* and the species-groups within *Morophaga* are debatable; drastic rearrangement of the tree is possible with very little increase in the number of character-steps involved. The sequence adopted here for *Amorophaga*, *Diataga* and the species-groups of *Morophaga* is therefore arbitrary.

The integrity of *Morophaga* + *Diataga* + *Amorophaga* is supported by all methods except single-link and unweighted centroid cluster analysis. This group appears to be genuinely monophyletic, defined by the derivation of characters 1, 2, 10 and 23 and the reversal of 31 in the PAUP tree: character 20 (basal lobe of valva) also supports the monophyly of the group if the occurrence of valval lobes of rather different type in *Afroscardia* and *Scardiella* is ignored (see above). Characters 20 and 23 (modified interpretation) are uniquely derived but 23 undergoes reversal twice. Characters 1 and 2 are derived three times, character 10 twice (it is otherwise an autapomorphy of *Gentingia*).

All analyses except single-link and centroid clustering support the sister-group relationship of *Miniscardia* and *Necroscardia* but the two groups are united only by the convergent derivation of characters 1 and 5 in the PAUP tree. Both characters occur twice elsewhere.

The sister-group relationship of the two *Moscardia* species is supported by all analyses: five character changes are involved but these all occur also elsewhere. The sister-group relationship of *Perilicmetis* to *Moscardia* is supported by cladistic and most phenetic analyses. The four character changes involved include one uniquely derived character (33). The grouping is further supported by character 32 which, however, occurs also in *Cnismorectis* and *Hormantris*.

Scardia and *Daviscardia* are paired by all analyses. On the PAUP tree their relationship is supported by changes to characters 2, 4, 12, 21, 25 and 39. Each of these is very homoplasious with a minimum of three independent apomorphic occurrences.

The sister-group relationship of *Cnismorectis* and *Hormantris*, supported by all analyses, involves derivation of eight characters and reversal of one. Two of the characters (7, 8) are uniquely derived and three more (32, 34, 45) are derived elsewhere only once. The sister-grouping of *Pectiniscardia* with *Cnismorectis* + *Hormantris*, found by all cladistic methods and average-link cluster analysis, is supported by two derived characters and three reversals. One character (54) is uniquely derived; the other is multiply derived. One of the reversals (13) is of a character that is otherwise uniquely derived; the other two characters are multiply derived and reversed.

The Old World and New World species of *Morophagoides* are grouped in all analyses; on the PAUP tree their relationship is supported by two derived characters, one unique (29) and the other multiply derived, and two reversals, both of characters multiply derived and reversed.

Two other groups in the PAUP tree are defined by uniquely derived characters that exhibit also a single reversal. Characters 9 and 13 appear in the data matrix as synapomorphies of

Diataga and the *Morophaga sistrata*-group and of *Cranaodes* and *Gentingia* respectively but attract a high number of 'hits' (see above) and are accounted for in the PAUP tree as homoplasious. No method of analysis recovers these pairs of OTUs together.

Other groups are not consistently recovered by either phenetic or cladistic methods although there is strong suggestion of a close relationship between the *Morophaga choragella*-group and *M. clonodes* from phenetic analysis.

Groups other than the six discussed above may be defined only in terms of characters that are highly homoplasious; none of the groups is convincing. The limited phylogenetic hypothesis proposed here is therefore that the six groups (with the possible exception of *Miniscardia* + *Necroscardia*) constitute monophyletic entities. The remainder of the PAUP tree is adopted as a curatorial convenience.

Discussion

The impossibility of obtaining a consistent classification of OTUs within the Scardiinae reflects two factors, the high degree of homoplasy encountered throughout the group, and the limitations placed upon the range of characters with which it was possible to work through paucity of material.

Studies such as this underline the dangers of subjective character-assessment. Spectacular specialized structures such as elongate corematal apodemes (character 15) or the valval pectinifer (present in two *Morophaga* species and *Pectiniscardia*) prove to be homoplasious, while apparently insignificant characters such as abdominal microtrichia (32, 33) would appear to have much greater 'information value' in classification. Certain characters are alarmingly homoplasious, for example dorsal fusion (or otherwise) of the tegumen, modification of the juxta, presence or absence of coremata, reduction of the maxillary palpus, and surface structure of the aedeagus. The homoplasy of the coremata has already been alluded to (Robinson, 1981) but the other characters are 'traditional' taxonomic characters and, if their behaviour in other groups parallels that in the Scardiinae, our trust in them is perhaps misplaced.

It is not suggested here, of course, that phenetic methods should produce results congruent with those of cladistic techniques. However, given that the criterion for clustering or agglomeration is the pattern of distribution of '1's in the data matrix (apomorphies among OTUs) then mimicry of pattern will tend to emerge in the form of the common occurrence of (usually terminal) groups or clusters. However, it is axiomatic that phenetic techniques cannot be relied upon to identify monophyletic groups. Cladistic testing of phenetic clusters is necessary to establish that they are natural groups in the phylogenetic sense. The weaknesses of both methods in situations involving homoplasy are obvious. Phenetic classifications are even more unlikely to be natural classifications.

Use of the methods described above permits the identification of groups that are recovered consistently and which might be described as 'robust groups'. Cladistic methods identify those characters by which such robust groups may be defined. Character-compatibility methods measure objectively (within the context of the data) the robustness of characters. Robust groups of OTUs are usually defined by robust characters. Character-compatibility methods further identify and predict (by the 'hits' procedure) the occurrence of single instances of convergence or reversal. A consensus obtained using these methods provides a strong (but, admittedly, subjective) indication that robust groups are natural groups, an indication that cannot be obtained by any one method in isolation.

The classification offered here is, therefore, a very conservative one. Nevertheless, it is entirely at variance with that proposed by Zagulajev (1973). He suggested *Amorophaga* and *Morophagoides* as sister-groups, *Scardia* as the sister-group of these, and *Morophaga* as the sister-group of all three (Zagulajev's *Scardia* includes *Montescardia*, separated in the present work).

Geographical distribution

It has been impossible to resolve fully a phylogeny for the Scardiinae so comment on

biogeography in relation to phylogeny must needs be restricted to the few unequivocal sister-groupings recognized.

The overall pattern of diversity of the Scardiinae is dominated by *Tinissa*, with 34 species. These range from the Afrotropical region (5 species) through the Oriental region (19 species) to the Australian region (New Guinea, Solomon Is, Australia – 13 species) but are poorly represented in Australia itself where there are only two species, both of these found also in New Guinea. Further comments on the distribution of *Tinissa* have been given elsewhere (Robinson, 1976*a*; 1981). Apart from *Tinissa*, Australia has only one other species of Scardiinae, *Morophaga clonodes*. Its possible sister-group (suggested by only phenetic analyses) is the *M. choragella*-group which consists of four Palaearctic species. Penetration of the Australian region by Scardiinae is restricted otherwise to *Morophaga bucephala* which ranges from Japan to New Guinea.

Excluding *Tinissa*, Scardiinae are represented in the Afrotropical region almost as poorly as they are in Australia. Two of the four species of the *Morophaga bucephala*-group occur there, one widespread in forested areas of the African mainland and the other restricted to Madagascar. In addition to these, four monobasic Scardiinae genera have been found in Africa. Each is known only from a few specimens and the phylogenetic position of each is uncertain. Three of the genera, *Afroscardia, Leptozancia* and *Philagrias*, occur on the mountains of east Africa at altitudes over 2400 m (8000′). The fourth, *Semeoloncha*, occurs in the rain forests of west Africa. The current picture of Scardiinae diversity in the Afrotropical region may, however, be misleading. Few specimens have been collected yet the generic diversity among these is great. It is probable that the material available in collections falls far short of being a true representation of the group. It is likely that further collecting and, particularly, the use of specialized collecting techniques, may increase substantially the range of Scardiinae genera known from the Afrotropical region.

No Scardiinae are known from southern South America (Patagonia) despite extensive recent collecting of Microlepidoptera by workers from the U.S.A. and Denmark. The virtual absence of Scardiinae from the southern continents suggests strongly that the group evolved after the break-up of Gondwanaland.

In contrast, the Neotropical region has a greater concentration of Scardiinae genera (13) and (if *Tinissa* in the Oriental region is excluded) of species (32) than any other region. Again, the number of specimens known of each species is small and the diversity suggested here is probably a considerable underestimate. Three genera, *Morophagoides*, *Daviscardia* and *Diataga*, are particularly diverse, accounting for 19 of 32 species. All are found in forest habitats and have a considerable altitude range, *Morophagoides* especially so, *M. iulina* having been collected at at least 2600 m (8500′). The remaining Neotropical genera occur in forested habitats generally below about 2000 m (6550′) from the eastern slopes of the Andes and the mountains of Central America (*Cnismorectis*, *Necroscardia*, *Moscardia*, *Cranaodes*) to the delta forest of the Amazon basin (*Perilicmetis*, *Miniscardia*); *Bythocrates* is known only from Trinidad, and *Diataga* is widespread. *Pectiniscardia* and *Hormantris* are exceptional in that they are found at altitudes comparable to those at which live the Scardiinae of the east African mountains. Both genera are monobasic and represented by single specimens collected in the central Cordillera of Colombia at over 3500 m (11,500′). *Hormantris* is the sister-group of *Cnismorectis*. A single example of *Scardia anatomella* is known from the Neotropical region.

The Nearctic Scardiinae fauna is poor with only eight genera and 10 species. One species of *Diataga*, one of *Miniscardia*, two of *Morophagoides* and two of *Daviscardia* represent the diverse Neotropical element at its northern limit. *Montescardia*, *Scardia* and *Amorophaga* are Holarctic genera each represented by single species in North America. The monobasic *Scardiella* is the only Scardiinae genus restricted to the Nearctic region.

The Palaearctic region has a similarly sparse Scardiinae fauna, with five genera, these represented in both the eat and the west of the region. The 16 Palaearctic species are divided evenly between west and east. *Morophagoides* (also in the Neotropical and Nearctic regions) is represented by three species, the Holarctic genera *Montescardia*, *Scardia* and *Amorophaga* by two, three and three species respectively. The remaining six species are those of *Morophaga*.

This genus is also well-represented in the Oriental region with a further six species. The paucity of Scardiinae in the Holarctic region may be connected with the presence of Nemapogoninae as part of the guild of fungivorous larvae. Nemapogoninae are absent from both the Old and New World tropics.

Four genera and 10 species of Scardiinae, excluding *Tinissa*, are now recorded from the Oriental region. In addition to representatives of *Morophaga* (including the *sistrata*-group, endemic to the Oriental region), there are two species of *Scardia*, one of *Cranaodes* (known otherwise from the Neotropical region), and the monobasic genus *Gentingia*, of uncertain affinities.

The sister-group relationship of *Daviscardia* and *Scardia* provides a scenario of dispersal and speciation that may be mirrored also in other groups. *Daviscardia* is a Neotropical genus with a further two species in the U.S.A. *Scardia anatomella* (also from the U.S.A.) is suggested (below) to be the sister-group of all other *Scardia*. The pattern of present-day distribution of *Scardia* species suggests dispersal of the Old World *Scardia* ancestor from North America to eastern Asia with progressive southward and westward dispersal and isolation to provide the hypothesized phyletic sequence: *assamensis* (Himalayas/N. India), *amurensis* (E. Palaearctic/ Japan), *alleni* (Borneo), and *boletella* and *caucasica* (W. Palaearctic). In this case speciation has involved adaptation within one genus to a wide variety of climates.

It is tempting, particularly in view of the presence in the Oriental region of what may be a genuine *Cranaodes* species, to view the phylogeny of the Scardiinae in terms of a series of dispersal events from a Neotropical centre. This model is fitted, for example, by *Morophagoides* and by the hypothesis of a sister-group relationship for *Necroscardia* and *Tinissa*, the Afrotropical origin for *Tinissa* (Robinson, 1976*a*) now being unlikely in the light of the discovery of a 'primitive' species in the New Guinea subregion (Robinson, 1981). However, in the absence of a more sound phylogenetic hypothesis this can only be speculative.

Abbreviations

BMNH	British Museum (Natural History), London, England
CAS	California Academy of Sciences, Los Angeles, California, U.S.A.
EIHU	Entomological Institute, Hokkaido University, Sapporo, Japan
HNHM	Hungarian Natural History Museum (Természettudományi Múzeum), Budapest, Hungary
LN	Landessamlungen für Naturkunde, Karlsruhe, West Germany
MCZ	Museum of Comparative Zoology, Harvard University, Cambridge, Massachusetts, U.S.A.
MINGA	Muzeul de Istoria Naturala 'Grigore Antipa', Bucharest, Rumania
MNHN	Muséum National d'Histoire Naturelle, Paris, France
MNHU	Museum für Naturkunde der Humboldt-Universität, Berlin, East Germany
NM	Naturhistorisches Museum, Vienna, Austria
NMNH	National Museum of Natural History, Smithsonian Institution, Washington D.C., U.S.A.
RNH	Rijksmuseum van Natuurlijke Historie, Leiden, Netherlands
SAM	South Australian Museum, Adelaide, Australia
SM	Sarawak Museum, Kuching, Sarawak
UC	University of California, Berkeley, California, U.S.A.
ZI	Zoological Institute of the Academy of Sciences, Leningrad, U.S.S.R.
ZM	Zoologisk Museum, Copenhagen, Denmark

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SCARDIINAE Eyer

Scardiinae Eyer, 1924: 320; Zagulajev, 1966: 634; Căpuşe, 1968: 122; Zagulajev, 1973; Gozmány & Vári, 1973: 147. Type-genus: *Scardia* Treitschke.

Semeolonchini Căpuşe, 1971: 232. Type-genus: *Semeoloncha* Gozmány. **Syn. n.**

Tinissinae Gozmány & Vári, 1973: 84; Robinson, 1976; Robinson, 1981. Type-genus: *Tinissa* Walker. **Syn. n.**

Adult. Vertex with tufts of erect scales convergent towards mid-line of head and tending to form whorls at back of head; scale bases often divided medially and transversely into four groups by narrow bare areas. Frons with tufts of erect and slightly upward-directed scales convergent with scale tufts of frontovertex; scale-bases either scattered evenly or forming upper medial group (sometimes divided vertically) and pair of lateral groups close to tentorial pits. Epipharynx triangular or hardly developed. Pilifers present except in *Hormantris* and *Cnismorectis* (Figs 180–182). Mandible present, elongated transversely. Galeae present in all species examined except *Tinissa polystacta*, only rarely associated, if at all, rarely much longer than second segment of labial palpus. Cibarium without chemoreceptor pits in *Morophaga*, *Scardia*, *Tinissa* and *Montescardia* but pits present in *Bythocrates*, *Perilicmetis* and *Cnismorectis* (not checked in other genera). Maxillary palpus elongate, 5-segmented and folded in many species but in some substantially reduced in length and with five, four or three segments; second segment frequently with thick patch of dark scales above; first segment lacking sensilla trichodea; terminal segment with whorl of pale scales in most species of *Tinissa*. Labial palpus three-segmented, elongate, upturned at about 60°; second segment enormously elongated in *Hormantris* and *Cnismorectis*; lateral bristles of second segment sparse, scattered along length and never concentrated apically to form a terminal whorl; third segment with vom Rath's organ either present but small or apparently absent. Antenna one-half to four-fifths length of forewing. Scape elongate barrel-shaped; pecten present with 4–10 sparse bristles or large and thick with 15 to more than 40 bristles. Pedicel short, barrel-shaped, less than twice as long or broad as adjacent flagellar segments. Flagellar segments ciliate, cilia short in females, rarely longer than flagellar diameter, more elongate in males, up to four or five times as long as flagellar diameter, in some taxa restricted to ventral half of segment; each segment with whorls of overlapping scales arranged in longitudinal rows, in some genera the whorl incomplete ventrally; most segments with well-developed palisaded sensilla coeloconica. Forewing with all veins present; cell with at least traces of forked M and with at least traces of chorda; stalking of R_3 and R_4, R_4 and R_5, M_2 and M_3, or M_3 and CuA_1 occurs in some genera (Figs 183, 184). Pattern usually cryptic, resembling mottled tree-bark, or with dark ground colour and pale apex and dorsum, or consisting of bold blotches on a paler background, rarely almost unicolorous (*Bythocrates*, *Afroscardia*, some *Tinissa*). Hindwing with all veins present, trace of forked M in cell; female with three (or, occasionally, four) frenular bristles (but with about 15 in *Scardia*). Legs without significant modification; spines absent; epiphysis present, strong, elongate peg-shaped; mid-tibia of many species with oblique pale band on outer surface; hind tibia with conspicuous distal whorl of erect scales in *Tinissa*.

Genitalia ♂. Eighth segment with elongate tubular sternal apodemes associated with coremata in *Morophaga choragella*-group, *Diataga* and *Necroscardia*; flap-like apodemes from corners of sternite present in *Semeoloncha*, *Moscardia* and *Cranaodes*; sternite with postero-lateral processes in *Tinissa torvella* and *T. ruwenzorica*; eighth segment otherwise unmodified; coremata present or absent in pleural membrane. Saccus well developed, longer than broad in most genera. Tegumen broad, angled dorso-ventrally in most species and, in most, fused dorsally. Uncus bilobate, lobes sometimes fused with tegumen and with each other, complexly modified in some taxa but in others a pair of simple setose lobes. Gnathos absent. Subscaphium, if present, ribbon-like, ill-defined, but modified with pair of setose processes in one

species of *Tinissa*. Juxta, if present, simple or strongly modified, fused with valvae or free, in *Tinissa* and *Necroscardia* enormously enlarged and forming an integral part of a valve-juxta complex. Transtilla, if developed, forming a dorsal collar (*Morophaga*, *Diataga*) or, rarely, modified with labides (*Tinissa*, *Leptozancla*). Valva present (except, possibly, in *Leptozancla*), variously modified; valvae free or, in six genera, fused ventrally to form a single movable complex; pectinifer present in two species of *Morophaga* and in *Pectiniscardia*; articulated ventrodistal process absent. Aedeagus simple, free, with or without carinae, straight or almost so (but highly modified and partially fused with the valvae in *Montescardia*); inception of bulbus ejaculatorius laterobasal or subbasal; vesica smooth or with fine spicular cornuti (microtrichia) or, in a few species, with stout cornuti.

Genitalia ♀. Seventh segment with strongly spined sternite in *Necroscardia funeratella*; reduced to a narrow band and with corethrogyne in most *Tinissa* species; corethrogyne also present but segment of normal size in *Diataga* and *Cnismorectis*; tergite with spined posterior lobe in a few *Tinissa* species; otherwise unmodified. Eighth tergite of most species with 2–5 pairs of strong terminal or subterminal setae plus sparse smaller setae and, in some species, with a few scattered sensilla coeloconica and/or sensilla basiconica. Eighth sternite usually strongly sclerotized and modified to accommodate broad ostium, frequently with paired processes ventral, lateral or immediately dorsal to ostium each bearing a pair of strong setae. Antrum invariably developed, variously modified, incorporating inception of ductus seminalis dorsally or paradorsally or terminating just posterior to inception of ductus seminalis. Inception of ductus seminalis very close to ostium in some taxa, these frequently with bulbous outgrowth from ventral wall of ovipositor overlying ostium and possibly functioning as a closure. Ductus bursae looped to the right in some *Tinissa* and *Morophaga*, its internal surface with microtrichia or overlapping plaques in many species; some genera (notably *Tinissa*) with regular transverse constrictions such that the ductus resembles a shower-hose. Corpus bursae thin-walled, with signa in *Gentingia*, *Bythocrates* and *Morophagoides* only. Ovipositor elongate, slender, with single infold at rest, in most taxa about as long as the last three abdominal segments; posterior half with ventral rods arising from bases of papillae anales; apophyses posteriores extending anteriorly beyond margin of eighth sternite by about once or twice length of sternite.

Pupa (Figs 185–192). Antennae almost reaching wing-tips; wing-tips reaching fourth abdominal segment. Anterior and posterior transverse bands of dorsal spines present on abdominal segments 3–7 in males and 3–6 in females (anterior band on segment 3 represented only by a smooth ridge in *Diataga*); single (anterior) band present on segments 8 and 9 in males and 7–9 in females (but no spines on segments 8 and 9 and only anterior band present on segment 7 in *Diataga*; band on segment 9 reduced to only four spines in one example of *Morophaga sistrata*); trace of anterior band present also on second abdominal segment in *Scardia*. Band of spines on segment 8 incomplete medially in *Morophagoides*, complete in all other taxa examined (see 'Remarks'); band of spines on segment 9 incomplete medially in all taxa except *Morophaga cremnarcha* and in two of three males of *Morophaga morellus*. Cremaster with two pairs of ventral hooks in *Scardia* and some *Morophaga* but smaller inner pair absent in *Diataga* and *Morophagoides* and strongly reduced or absent in *Morophaga*. In rotting wood or in fungal sporophores, protruded prior to emergence of adult.

Larva (Figs 193–197). A1 of head only one-third length of A2; six poorly defined ocellar lenses present. L-group of prothorax bisetose; D1 setae of abdominal segments more widely separated than D2 setae; L-group of ninth abdominal segment bisetose. Dorsal cuticle with strong microtrichia. In rotting wood permeated by fungal hyphae or in hard (persistent) fungal sporophore.

Remarks. Description of the scardiine pupa is based on the study of *Morophaga choragella* (several examples of both sexes), *M. morellus* (3 ♂), *M. cremnarcha* (1 ♀), *M. hyrcanella* (1 ♀), *M. sistrata* (2 ♀), *Diataga leptosceles* (1 ♂, 1 ♀), *Scardia anatomella* (several examples of both sexes) and *Morophagoides burkerella* (1 ♀). Additionally, figures of female pupae of *Scardia boletella* and *Morophagoides moriutii* are given by Zagulajev (1973) and Moriuti (1976) respectively. The larval diagnosis is based on study of three larvae of *Diataga leptosceles* from Turrialba, Costa Rica, on the detailed description of *Morophaga choragella* by Hinton (1956), and on figures of *Scardia boletella* by Zagulajev (1973) and of *Morophagoides moriutii* by Moriuti (1976).

The terminology of larval setae adopted here for *Diataga leptosceles* follows that used by Hinton (1956) for *Morophaga choragella*. However, Moriuti (1976) uses the earlier terminology of Hinton (1946) and the reader is referred to MacKay (1963) for a discussion of the still unresolved differences between the two systems. Hinton (1946) terms the four anterior macrosetae of the prothoracic shield XD1, XD2, SD1 and SD2 (D1, XD1, XD2 and SD2 of Hinton, 1956) and the two posterior macrosetae D1 and D2 (D2 and SD2 of Hinton, 1956); the L-group setae of the ninth abdominal segment are L1 and L3 (L1 and L2 of Hinton, 1956).

The larva of *Diataga leptosceles* is similar to that of *Morophaga choragella* as described by Hinton but the positions of Va and Pb on the head are variable; the labrum has only three pairs of marginal setae, not four as in *choragella* or *Morophagoides moriutii* (Moriuti, 1976). On the abdominal segments D1 is strongly displaced ventrad in *Diataga* in comparison with *Morophaga* and *Morophagoides*. In *Morophagoides* the D-group setae are almost level; in *Morophaga* D1 is displaced slightly ventrad. In *Morophagoides* L3 on the abdominal segments is placed slightly further posteriorly than in *Diataga* or *Morophaga*.

Key to genera and species-groups of Scardiinae (males)

1 Hind tibia with strongly developed apical and subapical tufts of elongate, dark-tipped scales ***TINISSA*** (p. 108)
– Hind tibia rough-scaled above but scales never concentrated into conspicuous distal tufts 2
2 Antenna lacking dorsal cilia – cilia roughly restricted to ventral 180 degrees of each segment..... 3
– Antenna with dorsal cilia – cilia arranged through 360 degrees of each segment..... 10
3 Antennal segments completely scaled 4
– Antennal segments with ventral surface lacking scales 17
4 Antennal cilia shorter than 1·5 × flagellar diameter 5
– Antennal cilia longer than 1·5 × flagellar diameter 6
5 Forewing with M_3 and CuA_1 stalked; forewing speckled greyish brown with dark brown subterminal fascia (Fig. 40)..... ***PERILICMETIS*** (p. 92)
– Forewing with M_3 and CuA_1 separate; forewing dark purple-brown with pale termen and dorsum (Figs 41, 42)..... ***MOSCARDIA*** (p. 93)
6 Pilifers absent; second segment of labial palpus longer than width of head (*cf.* Fig. 182) ***HORMANTRIS*** (p. 102)
– Pilifers present; second segment of labial palpus shorter than width of head (Figs 180, 181)..... 7
7 Forewing with M_3 and CuA_1 stalked..... ***MINISCARDIA*** (p. 104)
– Forewing with M_3 and CuA_1 separate 8
8 Forewing pattern consisting of dark purple-brown ground-colour with pale terminal fascia, and small pale spots on posterior margin (Figs 53, 54); juxta complex, divided, forming a functional part of the valvae (Figs 108, 109)..... ***NECROSCARDIA*** (p. 106)
– Forewing pattern consisting of dark blotches on a pale bronze or cream ground-colour (but see *Cranaodes oroya*); juxta simple, undivided, or fused with valvae and not recognizable 9
9 Forewing with R_3 and R_4 stalked (Fig. 184); tegumen unbroken, completely sclerotized dorsally; valvae fused ventrally; aedeagus with fine spicular carinae (Fig. 103) ***GENTINGIA*** (p. 95)
– Forewing with R_3 and R_4 separate; tegumen broken dorsally by at least a membranous suture-line; valvae separate; aedeagus smooth-surfaced (Fig. 106) ..... ***CRANAODES*** (p. 98)
10 Antennal cilia longer than 1·5 × flagellar diameter 11
– Antennal cilia shorter than 1·5 × flagellar diameter 14
11 Antennal scape with more than 15 pecten bristles 12
– Antennal scape with fewer than 15 pecten bristles 13
12 Maxillary palpus with fewer than 5 segments; forewing uniformly brown (Fig. 51); juxta simple, entire. (Afrotropical region)..... ***AFROSCARDIA*** (p. 110)
– Maxillary palpus with 5 segments; forewing with mottled pattern or with pale markings concentrated at termen, costa and dorsum; juxta complex, divided, fused with valvae. (New World) ..... ***MOROPHAGOIDES*** (part) (p. 65)
13 Small (13–16 mm) Nearctic species; uncus complex, forming pair of widely separated digitate processes, not fused with tegumen; valva with simple ventral margin (Fig. 107) ***SCARDIELLA*** (p. 108)
– Large (27 mm) Neotropical species; uncus simple – a pair of setose lobes fused with tegumen; valva with ventral pectinifer of spines ..... ***PECTINISCARDIA*** (p. 101)
14 Antennal scape with more than 15 pecten bristles 15
– Antennal scape with fewer than 15 pecten bristles 16
15 Coremata present in eighth abdominal segment; juxta complex, enveloping aedeagus ***MONTESCARDIA*** (p. 74)
– Coremata absent from eighth abdominal segment; juxta, if present, fused with valvae and not recognisable..... ***MOROPHAGOIDES*** (part) (p. 65)
16 Large (20 mm) Afrotropical species; maxillary palpus 5-segmented; coremata present in eighth abdominal segment..... ***SEMEOLONCHA*** (p. 97)

– Small (11–14 mm) Neotropical species; maxillary palpus with fewer than 5 segments; coremata absent from eighth abdominal segment ..... ***BYTHOCRATES*** (p. 77)

17 Forewing with R_3 and R_4 free, widely separated at base (if R_3 and R_4 close together at base, then forewing pattern mottled purple-brown with pale termen and dorsum) 18

– Forewing with R_3 and R_4 fused, stalked or approximated at base; forewing lacking paler apex and dorsum 20

18 Pilifers absent; second segment of labial palpus longer than width of head (Fig. 182) ***CNISMORECTIS*** (p. 102)

– Pilifers present; second segment of labial palpus shorter than width of head 19

19 Coremata present in eighth abdominal segment; juxta complex, fused with valvae ***SCARDIA*** (p. 86)

– Coremata absent from eighth abdominal segment; juxta, if present, fused with valvae and not recognizable ..... ***DAVISCARDIA*** (p. 78)

20 Forewing with white or off-white ground-colour, marked with bold purple-brown basicostal and postero-medial blotches, with a group of smaller spots along costa becoming progressively larger towards apex (Figs 67–70) ..... ***MOROPHAGA bucephala*-group** (p. 121)

– Forewing pattern cryptic, resembling moss or tree-bark, or longitudinally streaked 21

21 Forewing pattern consisting of either brownish grey or khaki longitudinal streaks (Figs 57–59); uncus complex ..... ***AMOROPHAGA*** (p. 111)

– Forewing pattern resembling moss or tree-bark; uncus simple 22

22 Forewing slender; veins $R_3 + R_4$ and $M_2 + M_3$ fused, stalked or closely approximated at base (Fig. 183); outer mid and proximal hind tibial spurs very short – less than 0·4 length of inner spurs (Neotropical species) ..... ***DIATAGA*** (p. 114)

– Forewing broader; only R_3 and R_4 fused, stalked or closely approximated at base; outer and proximal hind tibial spurs usually more than 0·4 length of inner spurs (but slightly less than 0·4 in the Oriental *Morophaga sistrata*-group) 23

23 Coremata absent from eighth abdominal segment 24

– Coremata present in eighth abdominal segment 25

24 Outer mid and proximal hind tibial spurs less than 0·4 length of inner spurs; apices of uncus lobes fused together and tapered to form a small hook; vesica with line of strong thorn-like cornuti (Figs 131–137) ..... ***MOROPHAGA sistrata*-group** (part) (p. 126)

– Outer mid and proximal hind tibial spurs more than 0·4 length of inner spurs; apices of uncus lobes separate; cornuti small and spicular (Fig. 138) ..... ***MOROPHAGA clonodes*-group** (p. 129)

25 Apices of uncus lobes fused and tapered to form a small hook; vesica lacking any ornamentation (Fig. 135) ..... ***MOROPHAGA sistrata*-group** (part – ***borneensis***) (p. 126)

– Apices of uncus lobes separate; vesica with minute spicular cornuti 26

26 Uncus lobes short, hardly extending beyond apices of valvae, square-ended ***MOROPHAGA morellus*-group** (p. 125)

– Uncus lobes elongate, extending well beyond apices of valvae, apices tapered and rounded ..... ***MOROPHAGA choragella*-group** (p. 130)

Key to genera and species-groups of Scardiinae (females)

(Females of *Moscardia*, *Semeoloncha*, *Afroscardia*, *Pectiniscardia*, *Perilicmetis* and *Hormantris* are unknown.)

1 Hind tibia with strongly developed apical and subapical tufts of elongate, dark-tipped scales; most species with seventh segment reduced, tergite and sternite more than twice as wide as long, with corethrogyne of dense, fine, elongate hair-scales ..... ***TINISSA*** (p. 108)

– Hind-tibia rough-scaled above, but scales never concentrated into conspicuous distal tufts; seventh segment not reduced, corethrogyne present in *Cnismorectis* and *Diatagа* only 2

2 Forewing pattern consisting of longitudinal streaks or a 'moss' pattern disrupted by longitudinal streaking (Figs 57–59) ..... ***AMOROPHAGA*** (p. 111)

– Forewing pattern not consisting of longitudinal streaks 3

3 Forewing uniformly dark purple-brown ..... ***BYTHOCRATES*** (p. 77)

– Forewing variegated 4

4 Forewing pattern consisting of large purple-brown spots on a paler ground-colour 5

– Forewing coloration forming either a cryptic 'moss' or 'tree-bark' pattern or consisting of a pale termen and dorsum on a darker ground-colour 7

5 Forewing ground-colour white or off-white (Figs 67–70) ***MOROPHAGA bucephala*-group** (p. 121)

– Forewing ground-colour pale bronze 6
6 Maxillary palpus short, with fewer than 5 segments; forewing with R_3 and R_4 stalked (Fig. 184) ***GENTINGIA*** (p. 95)
– Maxillary palpus elongate, 5-segmented; forewing with R_3 and R_4 free ..... ***CRANAODES*** (p. 98)
7 Forewing with $R_3 + R_4$ and $M_2 + M_3$ stalked or very closely approximated at base (Fig. 183) ***DIATAGA*** (p. 114)
– Forewing with all veins free or only one pair of veins stalked..... 8
8 Forewing with M_3 and CuA_1 stalked..... ***MINISCARDIA*** (p. 104)
– Forewing with M_3 and CuA_1 free..... 9
9 Forewing with all veins free..... 10
– Forewing with R_3 and R_4 fused or stalked 17
10 Forewing pattern composed of pale termen and dorsum on darker ground-colour 11
– Forewing coloration forming a cryptic 'moss' or 'tree-bark' pattern 14
11 Frenulum with more than 10 bristles ..... ***SCARDIA*** (p. 86)
– Frenulum with fewer than 5 bristles..... 12
12 Bursa copulatrix with pair of large, opposed, pouch-shaped signa (Figs 140–144) ***MOROPHAGOIDES*** (part) (p. 65)
– Bursa copulatrix with many fine spicular signa, or without signa..... 13
13 Antennal pecten with more than 16 bristles; antrum less than one-half length of apophyses anteriores; ductus bursae smooth-walled (Figs 147–151) ..... ***DAVISCARDIA*** (p. 78)
– Antennal pecten with fewer than 16 bristles; antrum more than one-half length of apophyses anteriores; ductus bursae with fine, irregular transverse constrictions (Fig. 162) ***NECROSCARDIA*** (p. 106)
14 Pilifers absent; second segment of labial palpus longer than width of head (Fig. 182) ***CNISMORECTIS*** (p. 102)
– Pilifers present; second segment of labial palpus shorter than width of head (Figs 180, 181)..... 15
15 Bursa copulatrix with pair of large, opposed, pouch-shaped signa (Figs 140–144) ***MOROPHAGOIDES*** (part) (p. 65)
– Bursa copulatrix without signa..... 16
16 Large (22–28 mm) species; antennal pecten with more than 15 bristles... ***MONTESCARDIA*** (p. 74)
– Small (13–16 mm) species; antennal pecten with fewer than 15 bristles..... ***SCARDIELLA*** (p. 108)
17 Intersegmental membrane between eighth and seventh abdominal segments with pair of deep pouches with scobinate inner surfaces (Fig. 172) ..... ***MOROPHAGA clonodes*-group** (p. 129)
– Intersegmental membrane lacking such pouches or, if present, pouches shallow and with smooth inner surfaces..... 18
18 Corpus bursae not extending anteriorly beyond apophyses anteriores ***MOROPHAGA morellus*-group** (p. 125)
– Corpus bursae extending anteriorly beyond apophyses anteriores..... 19
19 Ductus + corpus bursae more than twice length of apophyses anteriores; antrum less than half length of apophyses anteriores (Fig. 179) ..... ***MOROPHAGA sistrata*-group** (p. 126)
– Ductus + corpus bursae less than twice length of apophyses anteriores or, if more, then antrum extending anteriorly beyond apices of apophyses anteriores ***MOROPHAGA choragella*-group** (p. 130)

MOROPHAGOIDES Petersen

Morophagoides Petersen, 1957: 593. Type-species: *Scardia ussuriensis* Caradja, 1920: 167, by original designation and monotypy.

Diagnosis. Antenna (male) with dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter (but not in species from the Old World). Scape with more than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; mottled coloration forming cryptic, coarse 'moss' pattern (but pale markings of some species concentrated at termen, costa and dorsum). Male lacking coremata in eighth abdominal segment. Male genitalia with complex uncus (simple in *burkerella*) separated from tegumen by narrow band of membrane; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae + juxta fused ventrally into a single movable complex, valvae without longitudinal cleft; saccus longer than wide; juxta complex, divided medially; however, juxta, if present, fused with

valvae and not recognizable as such in species from the Old World; vesica with spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

Conspicuous autapomorphies. Female with pair of strong, pocket-shaped signa in bursa copulatrix.

Distribution. Western and eastern Palaearctic region; Oriental region – Taiwan; Nearctic region – British Columbia, Washington State, Utah, California; Neotropical region.

Biology. See under entries for individual species.

Key to species of *Morophagoides*

Males (males of *pythium*, *nimbiferum* and *montium* are unknown)

1 Antennal cilia as long as or longer than 1·5 × flagellar diameter; juxta complex, bipartite. (New World) 2
– Antennal cilia shorter than 1·5 × flagellar diameter; juxta, if present, fused with valvae and not recognizable. (Old World) 4
2 Uncus with lateral margins strongly infolded, sharply serrate; valva with tuft of strong bristles on inner surface; juxta small, kidney-shaped; vesica without cornuti (Fig. 85)..... ***iulina*** (p. 73)
– Uncus with lateral margins smooth, not strongly infolded; valva with scattered fine setae on inner surface; juxta greatly enlarged, V-shaped; vesica with single strong cornutus 3
3 Uncus with lateral margins slightly infolded, corners of uncus with blunt protuberance (Fig. 83) ***berkeleyella*** (p. 69)
– Uncus with lateral margins not infolded, corners of uncus not protuberant (Fig. 84) ***burkerella*** (p. 70)
4 Lateral margins of uncus straight, apices slightly tapered and hooked ..... ***iranensis*** (p. 66)
– Lateral margins of uncus produced to form a ventrally-directed process 5
5 Lateral processes of uncus short, subapical, double-ridged at extremity (Fig. 80) ***ussuriensis*** (p. 67)
– Lateral processes of uncus elongate, apical, extremity irregularly rounded (Figs 81, 82) ***moriutii*** (p. 68)

Females (females of *iulina* are unknown)

1 New World species 2
– Old World species 6
2 Antrum one-half or more length of apophyses anteriores 3
– Antrum less than one-quarter length of apophyses anteriores 5
3 Posterior margin of eighth sternite with deep, narrow medial emargination (m-shaped), with pair of short, blunt, setose subapical lobes (Fig. 140) ..... ***burkerella*** (p. 70)
– Posterior margin of eighth sternite ill-defined, surmounted by pair of strong caudally-directed setose digitate processes 4
4 Ostium narrow, ventral (anterior) margin deeply U-shaped; antrum tapered posteriorly (Fig. 143)..... ***pythium*** (p. 72)
– Ostium broad, ventral (anterior) margin transverse; antrum flared posteriorly .. ***berkeleyella*** (p. 69)
5 Ventral margin of ostium extended posteriorly as a pair of setose flaps, m-shaped (Fig. 144) ***montium*** (p. 71)
– Ostium set in membrane at anterior margin of eighth sternite, with pair of strongly sclerotized setose digitate processes posterior to ostium (Fig. 142)..... ***nimbiferum*** (p. 72)
6 Antrum running anteriorly from ventral lip of ostium without modification..... ***iranensis*** (p. 66)
– Antrum with strongly sclerotized triangular pocket in ventral wall, lip of pocket forming ventral lip of ostium..... 7
7 Ventral margin of ostium only slightly concave; antrum narrow, no broader than width of ostium..... ***ussuriensis*** (p. 67)
– Ventral margin of ostium strongly concave; antrum broadened at one-half to 1·5 × width of ostium (Fig. 141) ..... ***moriutii*** (p. 68)

Morophagoides iranensis Petersen

(Fig. 9)

‡*Morophagoides iranensis* Petersen, 1959: 573, 577. [Nomen nudum.]
Morophagoides iranensis Petersen, 1960: 1. Holotype ♂, Iran (LN) [not examined].

Adult (Zagulajev, 1973: fig. 93; Fig. 9). ♂, 17–23 mm; ♀, 19–28 mm. Vertex and frons cream, some

brown scales close to eyes. Labial palpus cream, dark brown on outer surface of first and second segment. Maxillary palpus mixed cream and dark brown, 5-segmented, reaching a little more than one-half length of second segment of labial palpus. Antennal scape, pedicel and basal flagellar segments dark brown above; cilia 1·0 × (♂) or 0·4 × (♀) flagellar diameter. Thorax cream flecked with light brown; tegula dark brown, cream at apex only. Forewing cream, scattered orange-brown scales along veins, strongly marked with dark brown to form a coarse, cryptic pattern resembling tree-bark. Hindwing light greyiwh cream with slightly darker greyish flecks. Legs cream; fore- and mid-legs strongly marked above with dark brown but pale at articulations; outer surface of mid-tibia with distinctive transverse pale streaks; outer mid-tibial and outer proximal hind tibial spurs 0·7 length of inner spurs.

Genitalia ♂ (Petersen 1960: fig. 1; Zagulajev, 1968: fig. 4; Zagulajev, 1973: figs 15D, 94). Saccus almost an equilateral triangle; uncus lobes large, divergent, elongately triangular, hooked at the apices. Subscaphium not developed. Juxta, if present, fused with valvae and not recognizable as such; transtilla not developed. Valva triangular, with large conical dorsocaudally-directed medial process; smaller blunt process from internal surface of valva close to base of ventral margin. Aedeagus about 10 × as long as broad in middle, with blunt subapical carina; vesica without cornuti (but large microtrichia possibly present).

Genitalia ♀ (Zagulajev, 1968: fig. 5; Zagulajev, 1973: figs 95, 96). Eighth tergite as long as eighth sternite, with three or four pairs of strong apical setae; eighth sternite forming pair of stout, setose, caudally-directed lobes lateral and dorsal to ostium; ventral margin of ostium slightly concave, protruded deeply ventrad. Antrum thick-walled, longitudinally constricted dorsoventrally, lined with microtrichia, twice length of eighth sternite. Ductus bursae thin-walled, finely microtrichiate, extending well beyond apices of apophyses anteriores. Corpus bursae ovate, with pair of small signa, each a flattened cone invaginated into wall of corpus bursae; bursa copulatrix overall more than twice length of apophyses anteriores.

Distribution. Iran; U.S.S.R. (Caucasus).

Biology Zagulajev (1973) has bred this species from a variety of polypores (*Fomes*, *Ganoderma*, *Polyporus*, *Coriolus*) on *Quercus*, *Zelcova* and *Parrotia* in the Caucasus.

Material examined. 108 ex., 10 pupae.

U.S.S.R.: 1 ♂, Adzharia, 15.vi.1969 (*Zagulajev*); 1 ♀, Georgia, 19.viii.1972 (*Zagulajev*) (BMNH). 'Central Europe': 1 ♂ (BMNH). Also a further 105 ex., 10 pupae (ZI) (see Zagulajev, 1973).

Remarks. The specimen from 'Central Europe' bears the registration number [18]76-75: this refers to an identified synoptic collection of 2500 European Microlepidoptera purchased from Staudinger. This specimen, with the reference number 687, was bought as an example of 'Scardia boleti' (i.e., *Morophaga choragella*) (BMNH Accession Register). It must be assumed that its locality label is as incorrect as its identification.

The three Old World *Morophagoides* species are allopatric and *iranensis* is the only *Morophagoides* to occur in the western Palearctic region. It differs from *ussuriensis* and *moriutii* in lacking any dark scaling on the third segment of the labial palpus but apart from this difference the three species are externally quite similar. The male genitalia of *iranensis* are distinguished by the divergent uncus lobes with hooked apices, and by the process from the valva being broadly conical: in the other two species the uncus lobes each bear a ventrally-directed nodular process, and the process from the valva is slender. The female genitalia of *iranensis* lack the conspicuous ventral triangular pocket that forms the ventral margin of the ostium in *ussuriensis* and *moriutii*; instead, the form of the antrum is conventional.

A tentative phylogeny for *Morophagoides* cannot be resolved because of the lack of material of most species. However, the Old World and New World species may form separate monophyletic groups (the New World species have a conspicuously modified juxta; the juxta is either lost or entirely fused with the valva in species from the Old World; species from the Old World have short antennal cilia; the cilia are long in species from the New World). Within these groups three sister-group pairings are apparent: *moriutii* + *ussuriensis* (synapomorphies: uncus lobes with nodular processes, ventral margin of ostium infolded to form a triangular pocket), *burkerella* + *berkeleyella* (see 'Remarks' for *burkerella*) and *pythium* + *nimbiferum* (see 'Remarks' for *pythium*).

Morophagoides ussuriensis (Caradja)

(Figs 10, 80)

Scardia ussuriensis Caradja, 1920: 167. Lectotype ♂, U.S.S.R. (MINGA), designated by Petersen (1957: 593) [not examined].

ADULT (Zagulajev, 1973: fig. 89; Fig. 10). ♂, 15–19 mm; ♀, 17–23 mm. Coloration and external structure similar to *iranensis* but maxillary palpus light greyish cream, outer surface of third segment of labial palpus with a few brown scales.

GENITALIA ♂ (Petersen, 1957: fig. 246; Zagulajev, 1973: figs 14b, 15G, 90; Fig. 80). Saccus triangular; uncus lobes broad, appressed to tegumen for only medial third of their width; lateral margin produced ventrad to form a strongly sclerotized knuckle-shaped process. Subscaphium indicated only by slight thickening of diaphragma close to base of valval apodemes. Juxta, if present, fused with valvae and not recognizable as such; transtilla not developed. Valva triangular, apex consisting of two overlapping lobes, inner lobe extended mesad to form an elongately triangular process with a sinuate apex, outer lobe forming a blunt process close to ventral margin of valva. Aedeagus about 14 × as long as broad in middle, with digitiform subapical carina; vesica with patch of large spicular microtrichia.

GENITALIA ♀ (Petersen, 1957: fig. 247; Zagulajev, 1973: figs 17G, 18b, 91, 92). Eighth tergite slightly longer than eighth sternite, with three or four pairs of strong subapical setae; eighth sternite forming pair of slender, setose, caudally-directed lobes dorsal to ostium; ventral margin of ostium transverse, protruding strongly ventrad. Antrum with conspicuous and strongly sclerotized triangular pocket in ventral wall, antrum itself behind the pocket, elongate, longitudinally constricted dorsoventrally, lined with microtrichia, about 2·5 × length of eighth sternite. Ductus bursae thin-walled, microtrichia at posterior end around inception of ductus seminalis at junction with antrum. Corpus bursae ovate, with pair of small pouch-shaped signa invaginated into wall of corpus bursae (Zagulajev figures (1973: fig. 92b) a pair of additional minute conical signa situated further posteriorly – I believe this to be an individual variation); bursa copulatrix overall more than twice length of apophyses anteriores.

DISTRIBUTION. U.S.S.R. (Amur, Chabarovsk, Maritime Territories).

BIOLOGY. Zagulajev (1973) associates this species with several genera of trees but no identifications of the host fungus have been made. Moriuti's detailed description (1976) of the life history of 'ussuriensis' from Japan refers to *moriutii* (see below).

MATERIAL EXAMINED. 26 ex., 2 pupae.

U.S.S.R.: 1 ♂, Vladivostok, 21.vii.1876 or 19.vii.1877 (*Christoph*) (genitalia slide no. 12356; BMNH); 1 ex. (head, thorax and forewings only), same data; 1 ♂, Amur, Raddefka, 3.viii.1876 (*Christoph*) (genitalia slide no. 12357; BMNH); 1 ♀, Ussuri Railway, Chabarovsk, 14.vii.1910 (*Borsow*) (BMNH). Also a further 22 ex., 2 pupae (ZI) (see Zagulajev, 1973).

REMARKS. Externally similar to *iranensis* and *moriutii*, *ussuriensis* has a restricted distribution on the easternmost mainland of the U.S.S.R. It is characterized by the conspicuous knuckle-shaped processes of the uncus lobes in the male genitalia. With *moriutii* it shares a conspicuous and diagnostic feature in the female genitalia – a conical ventral pouch, triangular in dorso-ventral view, which runs anteriorly from the ventral (posterior) margin of the ostium: the antrum proper has its posterior inception in the dorsal wall of this pouch although the pouch should be considered a part of the antrum too. Females of *moriutii* have a much more deeply concave ventral ostial margin than those of *ussuriensis*, and the medial region of the antrum is broader. However, the latter difference is subject to considerable intraspecific variation.

Morophagoides moriutii sp. n.

(Figs 11, 81, 82, 141)

[*Morophagoides ussuriensis* (Caradja); Moriuti, 1976: 86; Moriuti, 1982: 164. Misidentifications.]

ADULT (Moriuti, 1976: figs 1, 2; Moriuti, 1982: pl. 2, fig. 17, pl. 236, fig. 3; Fig. 11). ♂, 16–17 mm; ♀, 19–24 mm (Taiwanese specimens – ♂, 24 mm; ♀, 24, 29 mm). Coloration and external structure similar to *iranensis* but, like *ussuriensis*, maxillary palpus light greyish cream, outer surface of third segment of labial palpus strongly marked with brown in basal half.

GENITALIA ♂ (Moriuti, 1976: fig. 3; Moriuti, 1982: pl. 248, fig. 9; Figs 81, 82). Saccus triangular, slightly tapered; uncus lobes divergent, somewhat square, outer corners with ventrally-directed blunt process. Subscaphium poorly developed, represented by slight thickening of diaphragma. Juxta, if present, fused with valva and not recognizable as such; transtilla not developed. Valva with lobed deep apex and with elongate mesally-directed triangular process on internal surface. Aedeagus 15 × as long as broad in middle (stouter, only 10 × in Taiwanese examples), with digitiform subapical carina; vesica with patch of large spicular microtrichia.

GENITALIA ♀ (Moriuti, 1976: figs 4, 5; Fig. 141). Eighth tergite as long as eighth sternite, with three pairs of stout apical setae and about 8 pairs of scattered smaller setae; eighth sternite forming pair of small setose caudally-directed lobes dorsal to ostium; ventral margin of ostium concave, protruded strongly ventrad. Antrum with triangular and strongly sclerotized pocket in ventral wall, antrum itself behind the pocket, elongate, very thick-walled, longitudinally constricted dorso-ventrally, lined with strongly sclerotized and conspicuous nodular microtrichia, about 2·5 × length of eighth sternite. Ductus bursae lined with spicular microtrichia for almost entire length from inception of ductus seminalis anteriorly. Corpus bursae elongately ovate, with pair of pouch-shaped signa invaginated into wall; bursa copulatrix overall more than twice length of apophyses posteriores.

DISTRIBUTION. Japan; Taiwan.

BIOLOGY. Moriuti (1976) has described the biology of this species (as *ussuriensis*) in some detail and figured the larva and pupa. Specimens were reared from the fungus *Lentinus edodes* and its host timber. *Lentinus*, the shiitake fungus, is a valuable commercial crop used in gourmet cookery.

MATERIAL EXAMINED. 9 ex.

Holotype ♂, **Japan**: Honsyu, Okayama, Syootyo, ex cultured wood of *Lentinus edodes*, em. 15.vi.1968 (*Inoue*) (coll. S. Moriuti, Osaka).

Paratypes. **Japan**: 2 ♂, data as holotype (BMNH; coll. S. Moriuti); 1 ♂, 1 ♀, Honsyu, Nara, Katuragisan, ex polyporaceous fungus, em. 31.v.1961 (*Saito*) (BMNH; coll. S. Moriuti); 1 ♀, Honsyu, Nara, Koozindake, 1200 m, 2–3.viii.1971 (*Moriuti*) (coll. S. Moriuti).

Excluded from paratype series. **Taiwan** (Formosa): 1 ♂, 2 ♀, Arizan, 7000′, 14, 17, 17.ix.1906 (*Wileman*) (genitalia slide nos. 12360, 12361; BMNH).

REMARKS. Superficially similar to *iranensis* and *ussuriensis, moriutii* has a NW. Pacific distribution. The genitalia of both sexes are structurally close to those of *ussuriensis* but in the male the process from each uncus lobe is apical and irregular, not subapical and knuckle-shaped as in *ussuriensis*. In the female the ventral lip of the ostium is more strongly concave than in *ussuriensis* and the internal surface of the antrum is more markedly rugose.

The marked difference between the illustration of the uncus lobes of the male by Moriuti (1976: fig. 3) and that given here for a Japanese specimen (Fig. 81) is entirely due to the degree of compression of the preparation: in Fig. 81 the cover-slip is not in contact with the genital armature. Compression of the preparation of a specimen from Taiwan (Fig. 82) splays out the ventral processes of the uncus in similar fashion to that shown in Moriuti's illustration.

Specimens from Taiwan are substantially larger than those from Japan; the aedeagus is slightly thicker and the processes from the uncus are slightly narrower. However, at present I consider the two groups of specimens to be conspecific although I exclude Taiwanese material from paratype status.

Morophagoides berkeleyella (Powell)

(Figs 12, 83)

'Scardia' berkeleyella Powell, [1968]: 303. Holotype ♂, U.S.A. (CAS) [not examined].
Morophagoides berkeleyella (Powell) Davis, 1983: 5.

ADULT (Fig. 12). ♂, 14, 16 mm. Vertex and frons whitish, brown close to eyes. Labial palpus purple-brown but pale buff at apex and articulations and on inner surface. Maxillary palpus pale buff, 5-segmented, extending to about one-half length of second segment of labial palpus, basal three segments flecked above with purple-brown. Antennal scape, pedicel and flagellum dark brown, paler beneath; cilia 1·5 × (♂) flagellar diameter. Thorax and tegula dark brown flecked with paler scales. Forewing pale buff, strongly flecked with dark brown to form a speckled cryptic pattern (similar to that of *Morophaga morellus* in one example; in the other much more variegated and similar to that of *iulina* but more strongly speckled); fringe with pale apical spot, otherwise yellow-grey with grey basal band. Hindwing greyish cream with slightly darker irregular apical spots. Legs greyish ochreous; fore- and mid-legs dark grey above and on sides, articulations conspicuously white; outer mid-tibial spur and outer proximal hind tibial spur 0·7 length of inner spurs.

GENITALIA ♂ (Powell, [1968]: fig. 6; Fig. 83). Saccus narrowly triangular, concave laterally, as long as valva + juxta; uncus lobes moderately sclerotized, sparsely setose, fused dorsally and curved ventrad at sides, thus semicylindrical; corners produced slightly to form pair of shallow triangular processes. Subscaphium narrow, hardly sclerotized, spatulate anteriorly. Juxta partially fused with valvae, bipartite, forming pair of

large, blade-shaped caudally-directed processes extending well beyond apices of valvae. Valva short, globose, with digitate apical process. Aedeagus slender, 20 × as long as broad, with strong subapical corniform carina one-seventh length of aedeagus; vesica with fine spicular cornuti (microtrichia).

Genitalia ♀ (Powell, [1968]: fig. 7). (From Powell's description and illustration.) Eighth tergite slightly longer than eighth sternite; eighth sternite forming pair of stout setose lobes caudal to ostium; ventral margin of ostium irregular. Antrum short, elongately funnel-shaped, one-half length of apophyses anteriores. Ductus and corpus bursae pyriform, thin-walled, corpus bursae with pair of small pouch-shaped signa.

Distribution. U.S.A. (California).

Biology. Powell ([1968]) reared the type-series of this species from *Polyporus gilvus* on fallen *Quercus agrifolia*, from dead stems of *Lupinus*, and from a log of *Lithocarpus*: these data are reiterated by Lawrence & Powell (1969).

Material examined. 2 ex.

U.S.A.: 1 ♂ (paratype), California, 2 m. SE. of Canyon, Contra Costa County, ex *Polyporus gilvus* on fallen *Quercus agrifolia*, coll. 5.ii., emerged 9.iv.1967 (genitalia slide no. 2240 [Powell]; BMNH); 1 ♂, California, Burney Mt, 14.viii.1930 (genitalia slide no. 13107; BMNH).

Remarks. Most closely related to *M. burkerella, berkeleyella* is, however, a much smaller species. Powell ([1968]) suggests that it is less distinctly marked than *burkerella* but the male from Burney Mt is strongly variegated. The male genitalia of the two species differ substantially only in the form of the uncus lobes (compare illustrations) which are broader and flatter in *burkerella* than in *berkeleyella*. The female genitalia differ in that the signa are substantially larger in *burkerella* than in *berkeleyella*, the antrum is not as tapered and the ventral margin of the ostium is evenly convex. Whereas the caudal lobes of the eighth sternite are elongate and terminal in *berkeleyella*, they are very short and subterminal in *burkerella*.

Morophagoides burkerella (Busck)

(Figs 13, 84, 140)

Scardia burkerella Busck, 1904: 777. Holotype ♀, U.S.A. (NMNH) [examined].
Scardia gracilis Walsingham, 1907: 225. Holotype ♂, U.S.A. (NMNH) [examined]. [Synonymized by Davis (1983: 5).]
Scardia caryophylella Busck, 1908: 92. Holotype ♀, U.S.A. (NMNH) [examined]. [Synonymized by Davis (1983: 5).]
Scardia errandella Busck, 1908: 94. Holotype ♂, U.S.A. (NMNH) [examined]. [Synonymized by Davis (1983: 5).]

Adult (Fig. 13). ♂♀, 19–28 mm. Vertex and frons cream, brown close to eyes. Labial palpus brown, cream at apex and articulations and on inner surface. Maxillary palpus 5-segmented, extending to apex of second segment of labial palpus, buff, strongly flecked above with brown. Antennal scape, pedicel and basal segments of flagellum dark brown above, flagellum lighter distally; cilia 1·5 × (♂) or 0·3 × (♀) flagellar diameter. Thorax and tegula cream, dark brown in anterior half but mixed with cream on thorax. Forewing light yellowish buff, strongly speckled and blotched with dark brown to form a dense, cryptic pattern resembling tree-bark, usually with a strongly defined medial band; fringe barred, with well-defined grey basal line. Hindwing cream tinted with grey, with irregular terminal grey line; with apical grey spots extended into fringe; fringe with grey basal line. Legs pale yellowish buff; foreleg, mid-leg and hind tarsus strongly marked above and on sides with dark brown but pale at articulations; outer mid-tibial spur 0·8 length of inner; outer proximal hind tibial spur 0·7 length of inner spur.

Genitalia ♂ (Fig. 84). Similar to those of *berkeleyella* (q.v.) but uncus lobes broader, flatter, the sides not deeply folded ventrad.

Genitalia ♀ (Fig. 140). Eighth tergite slightly shorter than eighth sternite, with three pairs of elongate setae at caudal margin and a medial pair of sensilla basiconica; eighth sternite almost square but flared anteriorly, with narrow medial emargination posteriorly and pair of shallow subterminal setose lobes; ostium protuberant, ventral margin slightly convex; lip of antrum with three pairs of strong setae on internal surface. Antrum elongate, more than one-half length of apophyses anteriores, very thick-walled, with coarsely rugose internal surface. Ductus bursae short, thin-walled, lined with microtrichia, extending to apices of apophyses anteriores. Corpus bursae ovoid, thin-walled, with pair of large and strongly sclerotized shark's fin-shaped signa.

DISTRIBUTION. U.S.A.: California (Powell, [1968] – as *gracilis*) but possibly restricted to the Coast Range (Lawrence & Powell, 1969); Utah; Washington State; Pennsylvania (Forbes, 1923). Canada: British Columbia.

BIOLOGY. Recorded by Lawrence & Powell (1969) from a wide range of host Polyporaceae in California and recorded by Powell ([1968]) as possibly having two generations per year. Lawrence & Powell found this to be the commonest scardiine that they encountered in breeding from fungi and found it to be 'limited primarily to Polyporaceae with relatively large and persistent sporophores, or large colonies with extensive sterile tissue in species with small sporophores'.

MATERIAL EXAMINED. 37 ex.

Holotype ♀ (of *burkerella*), **U.S.A.**: Washington, Hoquiam, bred from *Tsuga heterophylla* (*Burke*) (genitalia slide no. 18654; NMNH). Holotype ♂ (of *gracilis*), **U.S.A.**: California (*Beutenmueller*) (genitalia missing) (NMNH). Holotype ♀ (of *caryophylella*), **U.S.A.**: California, Fieldbrook, 28.v.1903 (*Barber*) (abdomen missing) (NMNH). Holotype ♂ (of *errandella*), **U.S.A.**: [Washington State], (*Beutenmueller*) (abdomen missing) (NMNH).

U.S.A.: 30 ex., California, various hosts, dates and localities (genitalia slide no. 12400; BMNH; UC, Berkeley); 1 ♂, 1 ♀, Utah, Dividend, vii.1926 (BMNH). **Canada**: 1 ♂, British Columbia, Fraser Mills, 12.vii.1921 (*E.H.B.*) (genitalia slide no. 12399; BMNH).

REMARKS. This is the larger and commoner of the two North American *Morophagoides* species: for differentiation from *berkeleyella* see 'Remarks' for that species. *M. burkerella* and *berkeleyella* are probably sister-groups, exhibiting close similarity in the male genitalia, notably in the modification of the juxta of both species to form a pair of elongate, almost rectangular processes, and in the reduction of the valva to a globose shape with a terminal digitate process.

Morophagoides montium (Walsingham) **comb. n.**

(Figs 14, 144)

Phycis montium Walsingham, 1914: 359. Holotype ♀, PANAMA (BMNH) [examined].

ADULT (Fig. 14). ♀, 17 mm. Vertex and frons cream, mixed strongly with brown close to eyes. Labial palpus brown but cream at apex and articulations and on inner surface except for brown-dusted medial area on second segment. Maxillary palpus buff, brown above on basal segments, 5-segmented, extending probably no more than two-thirds length of second segment of labial palpus. Antennal scape, pedicel and basal flagellar segments dark brown, distal segments paler; cilia 0·3 × flagellar diameter. Thorax and tegula brown, slightly paler posteriorly. Forewing cream speckled with orange-brown and marked more strongly with dark brown to form a complicated cryptic pattern; dorsum generally lacking dark markings and thus conspicuously pale; fringe strongly chequered. Hindwing light brownish grey. Legs damaged but foreleg and mid-leg dull buff strongly marked above with grey-brown, pale at articulations.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 144). Eighth tergite almost circular, as long as eighth sternite, with three pairs of elongate setae and one or two shorter setae at caudal margin, with numerous pits (?sensilla coeloconica) scattered close to caudal margin; eighth sternite forming a strongly sclerotized plate ventral to ostium, terminating caudally in a pair of lobes; each lobe with a single elongate seta and numerous smaller spine-like setae at the tip; eighth sternite hardly sclerotized anteriorly; antrum triangular, short, strongly sclerotized; inception of ductus seminalis at apex of antrum. Ductus bursae thin-walled, lined with spicular microtrichia (broken and a section missing so length uncertain). Corpus bursae thin-walled, pyriform, with a pair of shallow pocket-shaped signa that are rectangular in lateral view.

DISTRIBUTION. Panama.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.

Holotype ♀, **Panama**: Volcan de Chiriqui, 2000–3000′, 1881 (*Champion*) (genitalia slide no. 15279; BMNH).

REMARKS. This species is small, of comparable size to *M. nimbiferum*, but considerably smaller than *pythium* or *iulina*. Its wing pattern is not as variegated as that of *iulina* but not as uniform in the anterior half of the wing as in *pythium* or *nimbiferum*. The hindwing is darker than that of *iulina* or *pythium*. The female genitalia are distinctive, characterized by the short antrum and by the lobes ventral to the ostium being

broad, situated far posteriorly, and with only a shallow emargination between them. In *pythium* the antrum is elongate, the ostium set in a deep emargination between the narrow processes of the eighth sternite; in *nimbiferum* the ostium is anterior, the processes arising caudally, and the eighth sternite strongly and complexly modified dorsal to the processes.

Walsingham's original description of *montium* was based on five specimens. One of these was expressly cited as 'Type' and two others (in NMNH) cited as paratypes. The remaining two specimens are implicitly excluded from type-status. They are, in fact, not conspecific with the holotype and are described below as new species – *pythium* and *nimbiferum*.

Morophagoides pythium sp. n.

(Figs 15, 143)

[*Phycis montium* Walsingham; Walsingham, 1914: 360. Partim – 1 ♀ only. Misidentification.]

Adult (Fig. 15). ♀, 24 mm. Vertex and frons cream, brown close to eyes. Labial palpus brown, cream at articulations; cream flecked with light brown on inner surface. Maxillary palpus pale buff flecked with brown; basal two segments strongly marked above with dark brown; 5-segmented, extending to about three-quarters length of second segment of labial palpus. Antennal scape, pedicel and basal flagellar segments dark brown above, distal segments lighter; cilia 0·5 × flagellar diameter. Thorax and tegula brown anteriorly, cream posteriorly. Forewing cream, lightly flecked with orange-brown, strongly marked with dark brown to form a cryptic 'moss-pattern' but termen, costa and dorsum less strongly marked and thus conspicuously paler; conspicuous small white subtornal spot. Hindwing pale greyish cream. Legs all wanting except foreleg – buff beneath, grey-brown above and on sides but pale at articulations.

Genitalia ♂. Unknown.

Genitalia ♀ (Fig. 143). Eighth tergite markedly longer than eighth sternite, with three pairs of strong subapical setae; eighth sternite short, folded laterally to accommodate bases of apophyses, with pair of narrow setose processes either side of ostium, folded anteriorly to ostium to form a shallow pouch. Antrum elongate, thick-walled, about one-half length of apophyses anteriores. Ductus bursae lined with microtrichia close to antrum, as long as antrum, thin-walled. Corpus bursae thin-walled, with pair of thin shark's fin-shaped signa set in sclerotized base-plates, each base-plate with and surrounded by scattered microtrichia.

Distribution. Costa Rica.

Biology. Unknown.

Material examined. 2 ex.

Holotype ♀, **Costa Rica**: Volcan de Irazu, 6000–7000′, 18— (*Rogers*) (genitalia slide no. 12383; BMNH).

Paratype. **Costa Rica**: 1 ♀, Puntarenas Prov., 6 km S. of San Vito, 2 or 5.v.1967 (*Veira*) (UC).

Remarks. With *nimbiferum* and *montium*, *pythium* forms a group of dark-patterened Neotropical species from which *iulina* is excluded by dint of its strongly variegated pattern. *M. pythium* is larger and has paler hindwings than *montium* and *nimbiferum*. The genitalia are distinctive in that the paired processes of the eighth sternite do not overly the ostium as in *montium*, are not entirely caudal to it as in *nimbiferum*, but form the lateral margins of the ostium and extend caudally. Like *nimbiferum*, the eighth tergite is considerably longer than the eighth sternite but the antrum is distinctly thicker and more elongate. Apart from *nimbiferum*, this is the only *Morophagoides* species to have microtrichia associated with the signa. *M. pythium* and *nimbiferum* may be sister-groups (synapomorphies: microtrichia in corpus bursae; eighth sternite 'shouldered' to accommodate bases of apophyses anteriores; ostium close to anterior margin of eighth sternite).

Morophagoides nimbiferum sp. n.

(Figs 16, 142)

[*Phycis montium* Walsingham; Walsingham, 1914: 360. Partim – 1 ♀ only. Misidentification.]

Adult (Fig. 16). ♀, 16 mm. Vertex and frons brownish cream, brown close to eyes. Labial palpus brown on outer surface but pale at apex and articulations; inner surface cream, small patch of brownish scales in middle of second and middle of third segment. Maxillary palpus light buff, strongly flecked above with

brown, 5-segmented, reaching three-quarters length of second segment of labial palpus. Antennal scape and pedicel dark brown above, flagellum damaged and mostly lost. Thorax and tegula brown anteriorly, light buff posteriorly. Forewing cream, sparsely flecked with orange-brown, strongly marked with dark brown; however, termen, dorsum and costal spots conspicuously pale. Hindwing light grey. Legs dull buff, fore- and mid-legs dark grey-brown above and on sides but pale at articulations and across mid-tibia; outer mid-tibial spur 0·7 length of inner; outer proximal hind tibial spur 0·6 length of inner spur.

Genitalia ♂. Unknown.

Genitalia ♀ (Fig. 142). Eighth tergite considerably longer than eighth sternite, with three pairs of large and two pairs of small marginal setae and about 10 scattered sensilla (basiconica and (?) coeloconica); eighth sternite short, strongly folded transversely, with strongly sclerotized 'shoulders' at bases of apophyses; medially with three convergent sclerites forming a flexible blunt process overlain by a lobate membranous outgrowth of the ovipositor; paired setose processes arising caudally to ostium, strongly divergent, each bearing a pair of large setae and numerous smaller setae at apex; ostium close to anterior margin of sternite. Antrum short, thick-walled, but hardly sclerotized, less than one-quarter length of apophyses anteriores. Ductus bursae half length of apophyses, lined with microtrichia in posterior half. Corpus bursae ovoid, with pair of thorn-shaped signa set in sclerotized base-plates, each base-plate with and surrounded by scattered microtrichia.

Distribution. Guatemala.

Biology. Unknown.

Material examined. 1 ex.

Holotype ♀, **Guatemala**: Volcan de Atitlan, 2500–3500′, [xii.1880], (*Champion*) (genitalia slide no. 12385; BMNH).

Remarks. This species is similar in size and external appearance to *montium* but the forewing pattern is less variegated. The genitalia are distinctive, however; the eighth sternite is strongly folded with elongate processes that arise posteriorly, and the ostium is close to the anterior margin, a configuration quite unlike that of any other species. Additionally, the signa differ from those of all other *Morophagoides* in being slender and thorn-like rather than laterally compressed and pocket-shaped. With *pythium*, *nimbiferum* is the only *Morophagoides* species to have microtrichia associated with the signa.

Morophagoides iulina (Walsingham) **comb. n.**

(Figs 17, 85)

Phycis iulina Walsingham, 1914: 359. Holotype ♂, Guatemala (BMNH) [examined].

Adult (Walsingham, 1914: pl. 10, fig. 17 (colour); Fig. 17). ♂, 26 mm. Vertex and frons whitish, light brown close to eyes. Labial palpus pale buff speckled strongly with dark brown on first segment and on basal two-thirds of second segment. Maxillary palpus whitish, 5-segmented, elongate, extending beyond apex of second segment of labial palpus, basal three segments flecked above with dark brown. Antennal scape and pedicel buff flecked with dark brown; flagellum pale buff; cilia 2·5 × flagellar diameter. Thorax and tegula dark purple-brown with only a few whitish scales posteriorly. Forewing cream mottled with pale orange-brown; strong W-shaped dark brown mark occupying most of wing; strong dark brown costal spots; terminal spots small but extending through fringe and giving a conspicuously chequered appearance to the fringe. Hindwing slightly greyish silk-white. Mid-legs missing; fore-leg strongly marked above with dark purple-brown; hind-leg pale buff, tibial spurs damaged.

Genitalia ♂ (Fig. 85). Saccus broadly triangular, apex rounded; uncus lobes almost semicircular, strongly folded, with conspicuously serrate inner edge. Subscaphium a broad but almost imperceptible thickening of the diaphragma. Juxta, if present, represented by a pair of shallow and inconspicuous ventral lobes at bases of valvae; transtilla represented by a pair of shallow membranous lobes dorsal to anellus. Valva simple, with subapical tuft of inwardly-directed strong spicular setae. Aedeagus about 8 × as long as broad at base, lacking carinae; vesica with minute spicular cornuti (microtrichia).

Genitalia ♀. Unknown.

Distribution. Guatemala.

Biology. Unknown.

MATERIAL EXAMINED. 1 ex.

Holotype ♂, **Guatemala**: Totonicapam, 8500–10,500′, [viii.1880], (*Champion*) (genitalia slide no. 12398; BMNH).

REMARKS. Among the American *Morophagoides* species, *iulina* is distinguished by its pale forewing ground-colour with strong W-shaped mark; it is large, of similar size to *burkerella*, and the female could well be the largest of the genus. The male genitalia are distinguished by the serrate uncus lobes and by the characteristic modified setae on the valvae. It is the only species of *Morophagoides* that does not have a blunt subapical carina on the aedeagus.

The affinities of *iulina* are obscure. The structure of its genitalia set it well apart from the other American species of which the males are known (*berkeleyella* and *burkerella*). However, the ventral lobes at the bases of the valvae may well be homologous with the enormously developed pair of lobes (assumed to be the juxta) in these species.

MONTESCARDIA Amsel

Montescardia Amsel, 1952: 139. Type-species: *Euplocamus tessulatellus* Zeller, 1846: 178, by original designation and monotypy.

DIAGNOSIS. Antenna (male) with dorsal cilia, ventral surface scaled; cilia shorter than 1·5 × flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; mottled coloration forming cryptic, coarse 'moss' pattern. Male with coremata in eighth abdominal segment; coremata not associated with apodemes. Male genitalia with complex uncus separated from tegumen by narrow band of membrane; tegumen broken dorsally by at least a membranous suture line; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae fused ventrally into a single movable complex, valvae without longitudinal cleft; saccus wider than long; juxta complex, entire, not divided medially; vesica lacking spicular cornuti; aedeagus with spicular or spinose carinae.

CONSPICUOUS AUTAPOMORPHIES. Juxta complex, enveloping aedeagus to form an elaborate, double-layered and partially fused intromittent complex; subscaphium broad, triangular; female with eighth tergite explanate, forming pair of broad lateral flanges (but not in *fuscofasciella*).

DISTRIBUTION. Holarctic.

BIOLOGY. See *Montescardia tessulatellus* (Zeller).

Key to species of *Montescardia*

Males (male genitalia of *fuscofasciella* are unknown)

1 Maxillary palpus elongate, reaching apex of second segment of labial palpus .... ***fuscofasciella*** (p. 76)
– Maxillary palpus short, only just reaching base of second segment of labial palpus 2
2 Caudal apex of juxta + aedeagus-complex fused, boat-shaped..... ***tessulatellus*** (p. 74)
– Caudal apex of juxta + aedeagus-complex bilobed, lobes separated by their own width ***kurenzovi*** (p. 75)

Females

1 Maxillary palpus elongate, reaching apex of second segment of labial palpus; posterior margin of ostium a protuberant ridge; ostium teardrop-shaped (Fig. 146) ..... ***fuscofasciella*** (p. 76)
– Maxillary palpus short, only just reaching base of second segment of labial palpus; posterior margin of ostium not defined, eighth sternite merging into membrane of ovipositor 2
2 Eighth tergite 1·3 × or more wider than long..... ***tessulatellus*** (p. 74)
– Eighth tergite roughly as wide as long ..... ***kurenzovi*** (p. 75)

Montescardia tessulatellus (Zeller)

(Fig. 18)

Euplocamus tessulatellus Zeller, 1846: 178. LECTOTYPE ♂, AUSTRIA (BMNH), here designated [examined].

ADULT (Fig. 18). ♂♀, 22–29 mm. Vertex and frons straw-coloured, tufts above eyes darker. Labial palpus straw-coloured, strongly flecked with brown on outer surface of second and third segments but pale at articulations. Maxillary palpus whitish, very short, only just reaching second segment of labial palpus, 5-segmented. Antennal scape and pedicel straw-coloured, dark brown above; flagellum grey-brown above; cilia 1·0 × (♂) or 0·7 × (♀) flagellar diameter. Thorax and tegula cream, strongly flecked with brown. Forewing cream, marked with orange-brown along veins and strongly flecked with dark brown to form ill-defined jagged medial and postmedial bands; medial costal spot strongly defined; strong dark spot at end of cell. Hindwing pale grey, mottled at margin and fringe. Legs straw-coloured, fore-, mid- and hindlegs strongly marked above and on outer surfaces with dark brown, but pale at articulations; outer mid-tibial spur 0·6 length of inner; outer proximal hind tibial spur 0·7 length of inner spur.

GENITALIA ♂ (Petersen, 1957: fig. 242, pl. 12, figs 1, 2; Zagulajev, 1973: figs 16A, 80, 81). Saccus short, triangular; uncus lobes strongly sclerotized, separated from tegumen by relatively broad membranous area, setose only apically and laterally, with irregularly serrate caudal margin. Subscaphium triangular. Juxta enveloping and partly fused with aedeagus to form an elaborate intromittent complex; transtilla not developed. Valvae fused ventrally to form a united complex with a narrowly V-shaped medioventral emargination; apices of valvae simple, rounded. Aedeagus fused with juxta to form intromittent complex; vesica without cornuti.

GENITALIA ♀ (Petersen, 1957: fig. 243; Zagulajev, 1973: figs 82, 83). Eighth tergite longer than eighth sternite, caudal one-quarter membranous, with four pairs of strong and elongate subapical setae posterior to irregular margin of sclerotization and with about six scattered pairs of sensilla basiconica; tergite explanate anteriorly to form conspicuous pair of quadrate lateral flaps; eighth sternite U-shaped, bases of arms of 'U' strongly folded, between arms a broad and deep depression leading to ostium which is overlain by a strong semicircular sclerite. Antrum short, longitudinally folded and with very fine transverse striations; inception of ductus seminalis at anterior end of antrum. Ductus bursae thick-walled, slightly longer than antrum. Corpus bursae large, ovate, extending well beyond apices of apophyses anteriores; signa absent.

DISTRIBUTION. Sweden; Norway; Finland (Krogerus *et al.*, 1971); Italy (Petersen & Gaedike, 1979); Sardinia (Amsel, 1952); central Europe including East and West Germany; Yugoslavia; Austria; Rumania; Hungary; Czechoslovakia; Poland; U.S.S.R. (European Region, Crimea, E. Siberia, Primorsk region); Mongolia.

BIOLOGY. Petersen (1969) has recorded this species from pore-fungi and from dead wood of *Picea* and *Fagus*.

MATERIAL EXAMINED. 82 ex.

Lectotype ♂, [**Austria**]: Semm[e]ring [approx. 80 km. SW. of Vienna], vi (*Mann*) (BMNH).

Poland: 1 ♀ (paralectotype), [approx. 15 km W. of Klodzkol] 'Sfd' ['between Reinerz and the Seefelder'], 29.vii (*Zeller*) (BMNH). 80 ex., various localities (see 'Distribution') (BMNH; ZI). (For details of ZI holdings see Zagulajev (1973).)

REMARKS. This species is characteristically patterned and, with its geographical context, should be identifiable without recourse to dissection. Unlike all other Palaearctic scardiines with this wing-pattern, all veins in the forewing are free and the forewing appears correspondingly broader than in, say, *Morophaga* (but beware of *Morophagoides iranensis*, worn specimens of which might be mistaken for *Montescardia*). Unlike most other scardiines, the hind tarsus in *Montescardia* is dark brown above, the pattern broken by pale scaling at the articulations. In the female, the eighth tergite is deeply recessed into the intersegmental membrane, forming a well-defined dorsal pouch with a strongly microtrichiate dorsal internal surface. This species and *M. kurenzovi* may be separated from the North American *fuscofasciella* by their having very short maxillary palpi: in *fuscofasciella* the palpi would, if unfolded, reach the apex of the second segment of the labial palpus. Separation of *tessulatellus* and *kurenzovi* is more problematical: the latter taxon is probably no more than a slight geographical variant of *tessulatellus* from the edge of its range. However, further material of *kurenzovi* is required to clarify its status. It may be tentatively separated from *tessulatellus* using the characters described in the key and below.

Montescardia kurenzovi (Zagulajev) **comb. n.**

Scardia kurenzovi Zagulajev, 1966: 637. Holotype ♂, U.S.S.R. (ZI) [examined].

ADULT. ♂♀, 21·5–23·5 mm. Coloration and external structure similar to *tessulatellus*.

GENITALIA ♂ (Zagulajev, 1966: fig. 2A; Zagulajev, 1973: figs 15A, 15b, 16B, 84). Similar to those of *tessulatellus* but apex of juxta-aedeagus complex with pair of separated lobes.

GENITALIA ♀ (Zagulajev, 1966: figs 2b, 2B; Zagulajev, 1973: figs 17A, 17b, 19A, 85, 86). Similar to those of *tessulatellus* but eighth tergite not as broadly explanate, outer corners of tergite acute.

DISTRIBUTION. U.S.S.R. (Maritime Territory); Kurile Is (Kunashir) (Zagulajev, 1973).

BIOLOGY. Unknown.

MATERIAL EXAMINED. 5 ex.

Holotype ♂, **U.S.S.R.**: Maritime Territory, Khasan district, Verkhnyaya Sidimi, 8.vi.1950 (*Zagulajev*) (ZI).

U.S.S.R.: 1 ♀ (paratype), data as holotype but nr Vladivostok, 8.iv.1956 (*Omelko*); 1 ♀ (paratype), data as holotype but Suchan, source of the Sitsa River, 28.viii.1928 (*Kurentsov*) (ZI); 1 ♀, data as first paratype but 24.vii.1950 (*Zagulajev*) (ZI); 2 ♀, Kurile Is., Kunashir, 5–7.vii.1962 & 6.vii.1964 (*Krivolutskaya*) (ZI – only one specimen present when examined by author).

REMARKS. It is unlikely that this taxon represents a good species (see 'Remarks' for *tessulatellus*); the differences between it and *tessulatellus* are subtle in the extreme. The BMNH collection contains a male *Montescardia* from Khabarovsk ('Chabarovsk') on the Amur River. This locality is at the edge of the geographical range of *kurenzovi* as recorded by Zagulajev (1973) and well beyond the eastern limit of *tessulatellus* recorded by the same author. However, this specimen is an entirely typical example of *tessulatellus*.

Montescardia fuscofasciella (Chambers) **comb. n.**

(Figs 19, 146)

Euplocamus (?) fuscofasciella Chambers, 1875: 257. LECTOTYPE ♀, U.S.A. (MCZ), here designated [examined].

Scardia pravatella Busck, 1908: 94. Holotype ♂, U.S.A. (NMNH), here designated [examined]. [Synonymized by Davis (1983: 5).]

ADULT (Fig. 19). ♀, 27 mm. Vertex and frons pale buff. Labial palpus off-white, strongly flecked with brown on outer surface. Maxillary palpus cream, flecked with brown above on basal segments, elongate, 5-segmented, reaching apex of second segment of labial palpus. Antennal scape, pedicel and basal flagellar segments dark brown above; flagellum medium brown; cilia 0·6 × (♀) flagellar diameter. Thorax and tegula speckled brown and cream. Forewing brownish cream, ill-definedly orange-brown along veins, strongly speckled with dark brown to form strong solid blotches and a well-defined medial transverse fascia. Hindwing light grey-brown, ill-defined paler mottling at apex. Legs greyish buff, fore- and mid-legs strongly marked above with dark brown but pale at articulations; hind tarsus also dark brown above but articulations pale; outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·5 length of inner spur.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 146). Eighth tergite markedly longer than eighth sternite, with three or four pairs of strong subapical setae; eighth sternite moulded round large pyriform ostium, apex emarginate, laterocaudal lobes each with pair of strong setae. Antrum very short, dorsal wall rugose; inception of ductus seminalis almost at level of ventral margin of ostium. Ductus bursae broad, with lepidote (?microtrichiate) inner surface, merging with elongately ovate corpus bursae. Corpus bursae thin-walled, extending slightly anteriorly beyond apophyses anteriores; signa absent.

DISTRIBUTION. U.S.A. (Kentucky (?), Pennsylvania, North Carolina, Texas (?)).

BIOLOGY. Unknown.

MATERIAL EXAMINED. 3 ex.

Lectotype ♀ (of *fuscofasciella*), **U.S.A.**: 'Kentucky' [but more probably Texas – see 'Remarks'] (*Chambers*) (genitalia slide no. 2563 [Davis]; MCZ). Holotype ♂ (of *pravatella*) (abdomen missing), **U.S.A.**: Pennsylvania, New Brighton, 23.viii.1902 (*Merrick*) (NMNH).

U.S.A.: 1 ex. (abdomen missing), North Carolina, 1884 (*Morrison*) (BMNH).

REMARKS. Distinguished from its congeners by its elongate maxillary palpus, *fuscofasciella* is a distinctly dark, speckly species somewhat reminiscent of *Morophaga morellus*. Apart from *Morophagoides bur-*

kerella it is the only North American scardiine of this size and wing-pattern. In *burkerella* the thorax and the apices of the tegulae are cream, not with mixed brown and cream scales, and the hindwing is pale cream with a slight greyish tint, considerably paler than the light grey-brown hindwing of *fuscofasciella*.

The female genitalia are very different from those of *tessulatellus*; the eighth tergite is not explanate, the inner surface of the ductus bursae is lepidote, and the shape of the eighth sternite is markedly different. The structure of the male genitalia, presently unknown, may prove *fuscofasciella* not to be a *Montescardia*. Its present placement should be considered provisional.

Chambers (1875: 258) refers to 'the foregoing descriptions of "Teneina [sic] from Texas" . . . the conclusion of a series'. The block of descriptions of Texan material appears to begin on p. 250 with *Gelechia saphirinella* and to include *fuscofasciella*. Although the lectotype is labelled 'Kentucky', the label is not by Chambers and may be erroneous. The type-locality must remain in question as the distribution of this species is hardly known.

BYTHOCRATES Meyrick

Bythocrates Meyrick, 1919: 268. Type-species: *Bythocrates drosocycla* Meyrick, 1919: 268, by monotypy.

Diagnosis. Antenna (male) with dorsal cilia, ventral surface scaled; cilia shorter than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus with fewer than 5 segments; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_3 and CuA_1 stalked or very closely approximated at base; mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. Male genitalia with simple uncus – a pair of setose lobes – separated from tegumen by narrow band of membrane; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae fused ventrally into a single movable complex, valvae without longitudinal cleft; saccus wider than long; juxta simple, entire, not divided medially; vesica with spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

Conspicuous autapomorphies. Valvae entirely fused ventrally, with no trace of a suture line (line of fusion also difficult to discern in some species of *Daviscardia*); corpus bursae of female with four strongly sclerotized, pocket-shaped (or wedge-shaped) signa; ductus bursae with oblique regular constrictions; female eighth tergite entirely divided medially.

Distribution. Neotropical region – Guyana, Trinidad.

Biology. Has been bred from *Polyporus* in Trinidad (label data).

Bythocrates drosocycla Meyrick

(Figs 20, 145)

Bythocrates drosocycla Meyrick, 1919: 268. Holotype ♂, Guyana (BMNH) [examined].

Adult (Clarke, 1970: pl. 16, figs 1, 1b; Fig. 20). ♂, 11 mm; ♀, 14 mm. Vertex and frons dull buff. Labial palpus dark brown but pale buff on inner surface of second segment. Maxillary palpus buff-cream, a few dark brown scales above close to base, short, 4-segmented, extending only to basal one-fifth of second segment of labial palpus. Antennal scape and pedicel dull buff, flagellum dark brown; cilia 1·0 × (♂) or 0·7 × (♀) flagellar diameter. Thorax and tegula dark brown. Forewing purple-brown with very slightly darker mottling forming an indistinct 'moss' pattern; costa with six or seven inconspicuous paler yellowish spots; termen with interrupted line of yellowish spots. Hindwing purple-brown. Legs dull buff; outer mid-tibial spur 0·5 length of inner; outer proximal hind tibial spur 0·6 length of inner spur.

Genitalia ♂ (Clarke, 1970: pl. 16, figs 1c–1e). Saccus shallow, triangular; uncus lobes slender, elongate, digitiform, widely separated. Subscaphium strongly sclerotized, shuttle-shaped. Juxta not identified; transtilla forming V-shaped arch between costae of valvae. Valvae fused; valval complex elongate, strongly sclerotized and setose at apex, with transverse ridge at three-quarters and pair of oblique sclerotized bars at one-half, these fused with transtilla. Aedeagus short, broad and stumpy, only 4 × as long as broad, smooth-surfaced; vesica with minute spicular cornuti (microtrichia).

Genitalia ♀ (Fig. 145). Eighth tergite divided medially, slightly longer than eighth sternite, with three pairs of stout terminal bristles; eighth sternite deeply folded transversely to form a triangular sterigma with

strongly sclerotized truncated apex overlying ostium and bearing pair of elongate setae plus single (?supernumerary) seta and a few scattered sensillae (?basiconica). Antrum not developed. Ductus bursae as long as apophyses anteriores, thin-walled, lined anteriorly with granular microtrichia from inception of ductus seminalis (at twice length of eighth sternite from ostium), oblique constrictions forming a characteristic pattern. Corpus bursae ovate, posterior half with regular transverse constrictions, thin-walled, with four stout, wedge-shaped and finely spinose signa.

DISTRIBUTION. Guyana, Trinidad.

BIOLOGY. Specimens have been reared from *Polyporus* in Trinidad.

MATERIAL EXAMINED. 3 ex.
Holotype ♂, **Guyana**: Bartica, ii.1913 (*Parish*) (genitalia slide no. JFGC 6639; BMNH).
Trinidad: 1 ♂, 1 ♀, reared from *Polyporus*, 1922 (*Urich*) (genitalia slide nos 1664, 13110; BMNH).

REMARKS. This small, dark species may be recognized simply by its external appearance: it bears a slight resemblance to *Diataga* but is smaller, darker and broader-winged. Forewing veins R_3 and R_4 are separate, unlike *Diataga*. Both male and female genitalia are distinctive, the male in that the valvae are strongly fused and the elongate uncus lobes are widely separated, and the female in that it is the only scardiine with more than two signa.

DAVISCARDIA gen. n.

Type-species: *Scardia coloradella* Dietz, 1905: 25.

DIAGNOSIS. Antenna (male) lacking dorsal cilia, ventral surface without scales; cilia longer or shorter than 1·5 × flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus with fewer than 5 segments; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; pattern consisting of pale termen and dorsum on darker ground-colour. Male lacking coremata in eighth abdominal segment. Male genitalia with complex uncus fused with tegumen; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae fused ventrally into a single movable complex, valvae without longitudinal cleft; saccus wider than long; juxta, if present, fused with valvae and not recognizable as such; vesica with spicular cornuti; aedeagus smooth-surfaced, without carinae, but minute spicular carinae present in two species.

CONSPICUOUS AUTAPOMORPHIES. None; however, this is the only group of species with a pale apex and dorsum in the forewing which lacks coremata; the deep, almost box-like fused valvae are also characteristic.

DISTRIBUTION. Neotropical region; Nearctic region – U.S.A. (southern states).

BIOLOGY. See *Daviscardia coloradella* (Dietz).

Key to species of *Daviscardia*
Males (males of *hypocritella* and *lupulella* are unknown)

1 Tegumen with caudally-directed lateral digitate processes 2
– Tegumen not produced laterocaudally 6
2 Tegumen with two pairs of caudally-directed processes (Fig. 95) ..... species A (p. 84)
– Tegumen with single pair of caudally-directed processes..... 3
3 Aedeagus slender, about 20 times as long as broad, with four or five small cornuti (Fig. 94) ***bicolorella*** (p. 84)
– Aedeagus stout, about 10 times as long as broad, with very many spicular cornuti 4
4 Processes of tegumen triangular; apex of saccus pointed (Fig. 93) ..... ***mackiei*** (p. 83)
– Processes of tegumen elongately triangular with extended apex; apex of saccus rounded 5
5 Uncus lobes simple, flap-like; outer surface of valva with shallow ridge; aedeagus with spicular carinae on ventral surface (Fig. 89)..... ***luctuosa*** (p. 82)
– Uncus lobes with triangular anterior process; outer surface of valva smooth; aedeagus smooth-surfaced 7
6 Valvae extended ventrally and caudally to form a pair of hand-shaped processes (Fig. 87) ***coloradella*** (p. 79)

– Valvae extended ventrally and caudally in a single, fused, irregularly-shaped process (Fig. 91) ***radulella*** (p. 80)

7 Uncus lobe with minute triangular internal (anterior) process; setae of valvae spine-like; medioventral emargination between valvae extending to one-third their length (Fig. 92) ***beckeri*** (p. 81)

– Uncus lobe with large triangular internal (anterior) process; setae of valvae thin and hair-like; medioventral emargination between valvae extending to one-half their length (Fig. 90) ***bimendella*** (p. 81)

Females (females of *bimendella, bicolorella, radulella* and species A are unknown)

1 Bursa copulatrix with fine spicular signa 2

– Bursa copulatrix without spicular signa (but spicular microtrichia may be present in the antrum) 3

2 Spicular signa arranged in an equatorial band (Fig. 148) ..... ***beckeri*** (p. 81)

– Spicular signa arranged in a pair of opposed T-shaped clusters (Fig. 150) ..... ***mackiei*** (p. 83)

3 Ductus bursae elongate and narrow, corpus bursae spherical; ventral margin of ostium transverse, with deep and narrow medial emargination (Fig. 151) ..... ***hypocritella*** (p. 86)

– Ductus bursae very short, corpus bursae elongately pyriform; ventral margin of ostium a pair of lobes 4

4 Emargination between lobes that form ventral margin of ostium broadly U-shaped; ductus bursae with sclerotized lateral patches anterior to inception of ductus seminalis (Fig. 147) ***coloradella*** (p. 79)

– Emargination between lobes that form ventral margin of ostium narrowly V-shaped; ductus bursae without sclerotization anterior to inception of ductus seminalis (Fig. 149) ***lupulella*** (p. 85)

Daviscardia coloradella (Dietz) **comb. n.**

(Figs 21, 86–88, 147)

Scardia coloradella Dietz, 1905: 25. LECTOTYPE ♂, U.S.A. (MCZ), here designated [examined on author's behalf by D. R. Davis].
Fernaldia coloradella (Dietz) Davis, 1983: 5.

ADULT (Fig. 21). ♂♀, 26–33 mm. Vertex whitish, frons brownish yellow. Labial palpus grey-brown, paler on inner surface, whitish at base and apex of terminal segment. Maxillary palpus light grey-brown, short, 3-segmented. Antennal scape, pedicel and flagellum dark brown; cilia 2·3 × (♂) or 0·5 × (♀) flagellar diameter. Thorax whitish flecked with brown; tegula whitish, brown anteriorly. Forewing purple-brown, paler spots along costa, with continuous whitish posterior and terminal fascia strongly flecked with purple-brown and tinged with orange-brown posteriorly; pair of conspicuous dark spots at apices of R_3 and R_4; brown flecks coalescing at tornus and fringe; posterior margin of dark fascia strongly sinuate. Hindwing very light brownish grey. Legs greyish buff, hindlegs paler, foreleg and mid-leg grey brown above but pale at articulations; outer mid-tibial spur 0·5 length of inner; outer hind proximal tibial spur 0·6 length of inner spur.

GENITALIA ♂ (Figs 86–88). Saccus shallow, almost square; uncus lobes very short, widely separated, but fused basally, each with setose ventral lobe bearing short triangular process with three or four stiff bristles; uncus lobes setose but strongly sclerotized, each with pair of spinose setae close to apex. Tegumen produced laterocaudally to form pair of rounded 'shoulders'. Subscaphium not developed. Juxta, if developed, fused with valvae and not recognizable but possibly forming caudally-directed hand-shaped process. Valva sinuate, fused with medial pair of hand-shaped processes, apex with dorsal ridge and chisel-shaped ventral tip. Aedeagus stout, 8 × as long as broad at middle, without carinae; vesica with numerous strong, spicular cornuti.

GENITALIA ♀ (Fig. 147). Eighth tergite longer than eighth sternite, with five pairs of stout subapical setae and two or three very small marginal setae, with scattered pits anterior to large setae; eighth sternite deeply folded to accommodate broad ostium, ventral margin of ostium with pair of large lobes, each bearing a pair of stout subapical setae and numerous smaller apical and subapical setae. Antrum broadly funnel-shaped, inception of ductus seminalis at apex of 'funnel' just beyond anterior margin of eighth sternite. Ductus bursae and corpus bursae contiguous, posteriorly with sclerotized region on left and irregularly-margined and more strongly sclerotized patch on right, wall between these patches with microtrichia; medial region thick-walled, anterior region ovoid, signa absent.

DISTRIBUTION. U.S.A. (Colorado, Arizona, Utah, New Mexico, Maine; Texas – Dietz, 1905); Mexico (Durango – Powell, [1968]; Lawrence & Powell, 1969).

BIOLOGY. Reared from fungus on *Pseudotsuga*, from *Polyporus* on *Pinus* and from *Ganoderma* on *Populus* in the U.S.A., and from *Ganoderma* on *Quercus* in Mexico (Lawrence & Powell, 1969).

MATERIAL EXAMINED. 7 ex.

Lectotype ♂, **U.S.A.**: Colorado, Durango, 9.xii.1899 (*Dietz*) (MCZ).

U.S.A.: 1 ♂ (paralectotype), New Mexico, Beulah, end of viii. (genitalia slide no. 12387; BMNH); 1 ex., Maine, Lincoln Co., 3 m. SE. Demariscotta, 14.vii.1969 (*Powers*) (UC); 1 ♀, Arizona, Cochise Co., upper Miller Canyon, Huachuca Mts, 6–7000′, 9.viii.1974 (*D. & J. Powell*) (BMNH); 1 ♀, Arizona, Redington (BMNH); 2 ♀, Arizona, Huachuca Mts, 27.ix.1903 (*Oslar*) (genitalia slide no. 12388; BMNH); 1 ♀, Utah, Wasatch Co., 7 m. E. of Springville, 6000′, 28.vii.1968 (*Doyen*) (BMNH).

REMARKS. This is the only *Daviscardia* species known to occur north of Mexico. It is larger than all other known species, the pale forewing fascia is more strongly speckled with brown, and the antennal cilia of the male are the longest of the genus, approached only by those of an unnamed species from Mexico (see below). The male genitalia are distinctive in that the tegumen does not bear the laterocaudal processes that are present in all other species except *radulella*; the valvae are produced ventrally to form a pair of hand-shaped lobes. These lobes may be homologous with the irregular, quadrate mediocaudal process between the valvae of *radulella* and with the hemicylindrical structure in the same position in *bicolorella*. By analogy with other genera, it seems likely that the juxta is implicated in these structures but that it is closely fused with the ventrobasal region of each valva and is not recognizable. However, in several species (for example, *mackiei*) there is no trace of any specialization at the ventral margin of the valva, and the juxta is either entirely subsumed into the valval complex or else has been lost. For the purpose of scoring character-states for numerical analysis, the juxta in *Daviscardia* is interpreted as primitively present and modified into a complex structure.

The female genitalia of *coloradella* are distinctive in their size, the presence of two sclerotized patches at the posterior end of the ductus bursae, and the deep U-shaped medial emargination of the ventral lip of the ostium.

I am unable to formulate a hypothesis of phylogeny for *Daviscardia*. However, two groups of species are recognizable – *coloradella* + *radulella* (with specialized ventral process(es) at the base(s) of the valvae, possibly derived from the juxta, and with the tegumen lacking laterocaudal processes) and all remaining species (with laterocaudal processes from the tegumen). Of the latter group, *bicolorella* has a ventral process between the valvae possibly homologous with that of *radulella*.

The identity of Mexican specimens, left in some doubt by Powell ([1968]), has not been confirmed.

Daviscardia radulella sp. n.

(Figs 22, 91)

ADULT (Fig. 22). ♂, 16 mm. Coloration and external structure similar to *bimendella* (see below) but vertex and frons pale yellow-ochre; antennal flagellum light greyish brown above; cilia 1·0 × flagellar diameter; thorax and tegula brown, thorax flecked with brownish cream. Forewing with narrow posterior cream fascia continuous with terminal fascia but almost broken at tornus; distal margin of anterior brown fascia strongly concave; costa with about eight cream flecks, two basal pairs of these coalesced and extended posteriorly to form conspicuous spots; terminal fascia with large brown spots between R_3 and R_5 and between M_1 and M_2. (All legs badly damaged or missing.)

GENITALIA ♂ (Fig. 91). Saccus rounded, with slightly angled apex; uncus lobes very shallow, simple, widely separated, fused basally, ventral lobe little more than a ridge. Tegumen not extended laterocaudally. Subscaphium represented by thickening of diaphragma, with spatulate anterior end. Juxta, if developed, fused with valvae and not recognizable but possibly forming irregularly quadrate ventral process between arms of valvae; transtilla not developed. Valva simple, with small and thorn-like apical and subapical processes. Aedeagus stout, about 10 × as long as broad in middle, lacking carinae; vesica with numerous stout spicular cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. Costa Rica.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♂, **Costa Rica**: Palo Verde, 5250′, 1920 (genitalia slide no. 12386; BMNH).

REMARKS. A small, speckly species, *radulella* may be recognized by the uniform head vestiture, short antennal cilia and marked extension of the dark forewing fascia towards the tornus. The male genitalia are distinctive in that there are no processes from the tegumen (as in *coloradella* – q.v.) and there is an irregularly quadrate ventral process between the bases of the valvae.

The holotype was originally identified by Meyrick in his collection as 'Cranaodes iulina Wals.'.

Daviscardia bimendella (Zeller) comb. n.

(Figs 23, 90)

Tinea bimendella Zeller, 1863: 143. LECTOTYPE ♂, VENEZUELA (BMNH), here designated [examined].

ADULT (Zeller, 1863: pl. 2, fig. 5; Fig. 23). ♂, 22 mm. Vertex white, frons brown. Labial palpus brown, whitish at articulations, apex, and on inner surface of first and second segments. Maxillary palpus brownish, very short, 3-segmented. Antennal scape and pedicel brown; flagellum ochreous; cilia 1·7 × flagellar diameter. Thorax and tegula whitish, anterior half of tegula brown. Forewing purple-brown with extensive continuous terminal and posterior whitish fascia flecked with brown; some orange-brown scales close to posterior margin at one-half; costa with large basal and smaller medial white spot. Hindwing off-white, diffusely flecked with grey at apex. Legs pale buff; foreleg strongly marked with dark brown above; mid-legs missing; outer proximal hind tibial spur 0·6 length of inner spur.

GENITALIA ♂ (Fig. 90). Saccus short, rounded; uncus lobes very short, widely separated and apparently not fused basally, each with pendulous ventrally-directed lobe bearing subapical triangular process. Tegumen produced caudally to form pair of lateral digitate processes. Subscaphium defined but only recognizable at spatulate anterior end. Juxta either not developed or entirely fused with valvae and unrecognizable. Valva simple, with shallow spine on terminal margin and with spined apex. Aedeagus stout, 10 × as long as broad in middle, lacking carinae; vesica with numerous strong, spicular cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. Venezuela.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Lectotype ♂, **Venezuela** (genitalia slide no. 13124; BMNH).

REMARKS. *D. bimendella*, with *beckeri*, *luctuosa*, *mackiei*, species A and *radulella*, forms a group of externally very similar species. With the much larger *coloradella*, *beckeri*, and the unnamed species from Mexico, it is conspicuous in having the male antennal cilia longer than 1·5 × the diameter of the flagellar segments; however, the male antenna of *luctuosa* is unknown. As in *coloradella*, *beckeri*, *luctuosa* and *mackiei*, the scales of the frons and vertex are of contrasting shades, the vertex whitish and the frons brownish. It may be separated from *beckeri*, *luctuosa* and *mackiei* by the broader pale terminal fascia in the forewing and by the large pale basicostal spot. This spot, although present in *mackiei*, is suffused with purple-brown in that species.

The male genitalia are very similar to those of *luctuosa* but each valva has a pair of terminal thorn-like projections and the uncus lobes each bear a triangular medioventral process; these are absent in *luctuosa*. The aedeagus is smooth-surfaced but in *luctuosa* it bears numerous minute spicular carinae. The male genitalia resemble even more those of *beckeri* but differ in that the armature is larger, the tegumen processes are broader and not as strongly pointed, and the free arms of the valvae are more elongate. The triangular medioventral process on each uncus lobe is hardly developed in *beckeri*.

Meyrick misidentified a male of *mackiei* and the holotype female of *hypocritella* as 'Cranaodes bimendella' in his collection.

Daviscardia beckeri sp. n.

(Figs 24, 25, 92, 148)

[*Phycis luctuosa* Walsingham, 1914: 358. Partim – 2 ♀ only. Misidentification.]

ADULT (Figs 24, 25). ♂♀, 14–21 mm. Coloration and external structure similar to *bimendella* but frons light brown, inner surface of third segment of labial palpus greyish (white in one female from Mexico),

antennal flagellum grey-brown, cilia 2·0 × (♂) or 0·4 × (♀) flagellar diameter; forewing costa with a few ill-defined paler flecks; hindwing light grey in females; outer mid-tibial spur 0·35 length of inner; outer proximal hind tibial spur 0·6 length of inner spur.

Genitalia ♂ (Fig. 92). Similar to those of *bimendella* but genital armature smaller, only about 1·05 mm long (about 1·30 mm in *bimendella*); uncus lobes not as elongate, subapical triangular process on each lobe very small and insignificant. Subscaphium well defined only at slightly spatulate anterior end, ribbon-like. Ventral emargination between valvae infilled to two-thirds by membranous 'bridge' (only to one-half in *bimendella*); setae of valvae stout and spine-like.

Genitalia ♀ (Fig. 148). Eighth tergite as long as eighth sternite, with three or four pairs of strong subapical setae and numerous terminal and subterminal pits; eighth sternite with lamellate surface and only slightly sclerotized dorsal to ostium, ventral lip of ostium m-shaped, lobes each bearing one pair of large setae and numerous small setae. Antrum with nodular/microtrichiate internal surface, terminating in strongly sclerotized colliculum well beyond margin of eighth sternite. Ductus bursae short, thin-walled, inception of ductus seminalis at junction with corpus bursae. Corpus bursae pyriform (but exaggeratedly so), posterior end sclerotized, sclerotization terminating anteriorly in equatorial band of spicular signa; corpus swollen anterior to signa, membrane thick-walled and finely reticulate, becoming thin-walled and smooth-surfaced in globular anterior region.

Distribution. Mexico; Costa Rica.

Biology. Unknown.

Material examined. 6 ex.

Holotype ♂, **Costa Rica**: Turrialba, 600 m, iii.1973 (*Becker*) (genitalia slide no. 9492; BMNH).

Paratypes. 1 ♂, 1 ♀, data as holotype, x.1971 and iii.1973 (coll. V. O. Becker, Brasilia); 1 ♀, data as holotype, x.1971 (genitalia slide no. 9493; BMNH).

Excluded from paratype series. **Mexico**: 2 ♀, Vera Cruz, Jalapa, 4500′, 1887 (*Schaus*; *Trujillo*) (genitalia slide no. 13126; BMNH).

Remarks. This species, similar to *bimendella*, *luctuosa* and *mackiei*, is difficult to recognize by external characteristics. It may be distinguished from *mackiei* by its considerably longer antennal cilia in the male, and from *bimendella* by the darker costal region of the forewing and the greater extension in the tornal region of the dark forewing fascia. The outer mid-tibial spur is shorter in *beckeri* than in *luctuosa* or *mackiei* (0·35 as opposed to 0·50 the length of the inner spur). The male genitalia are distinguished from those of *bimendella* as described above.

The female genitalia are very similar to those of *mackiei* but the spicular signa are in an equatorial band, not in a pair of opposed T-shaped clusters, and *mackiei* has no posterior sclerotized patch on the corpus bursae.

It is questionable whether the two females from Mexico are conspecific with the type-series. The genitalia of one specimen have been dissected (the other has the abdomen missing) and are illustrated (Fig. 148). In comparison with the dissected female from Costa Rica, there are only five strong setae on the eighth tergite (i.e. two pairs plus one supernumerary) whereas there are three pairs plus one in the Costa Rican specimen. The antrum is only very weakly sclerotized, the posterior region of the corpus bursae has only an irregular sclerotized patch, the shape of the corpus bursae is substantially different, and there is no reticulation of the membrane anterior to the signa. However, the Mexican specimen has mated whereas the Costa Rican example is virgin; this may account for the differences in the structure and thickness of the membrane of the corpus bursae and for the difference in its shape.

Daviscardia luctuosa (Walsingham) **comb. n.**

(Figs 26, 89)

Phycis luctuosa Walsingham, 1914: 358. LECTOTYPE ♂, Costa Rica (BMNH), here designated [examined].

Adult (Fig. 26). ♂, 20 mm. Coloration and external structure similar to *bimendella* but frons light brown, inner surface of labial palpus pale greyish; (antennae broken). Forewing pattern similar to *bimendella*, but tornal region of pale fascia narrower as distal margin of dark fascia is expanded towards tornus; pale costal spots (particularly basal spot) smaller than in *bimendella* and suffused with purple-brown; outer mid-tibial spur 0·5 length of inner; outer proximal hind tibial spur 0·6 length of inner spur.

GENITALIA ♂ (Fig. 89). Similar to those of *bimendella* but uncus lobes more widely separated, ventral lobe shorter and without triangular process; lateral processes of tegumen broader basally; valva with free caudal region more elongate, outer surface swollen and slightly ridged, spine on terminal margin represented only by slight irregular swelling; aedeagus similar to that of *bimendella* but ventral surface with numerous minute spicular carinae.

GENITALIA ♀. Unknown.

DISTRIBUTION. Costa Rica.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.

Lectotype ♂, **Costa Rica**: Volcan de Irazu, 6–7000′, 18— (*Rogers*) (genitalia slide no. 13129; BMNH).

REMARKS. This species is similar to *bimendella* (see 'Remarks', above) but the terminal pale forewing fascia is narrower and the pale costal spots much smaller. The male genitalia differ as described for *bimendella*.

The external similarity of *luctuosa* and its allies is such that Walsingham's syntype series of this species included the male and (provisional) female of *mackiei* as well as the (holotype) female of *lupulella* and two females of *beckeri*, and the holotype of *Moscardia varna*.

Daviscardia mackiei sp. n.

(Figs 27–29, 93, 150)

[*Phycis luctuosa* Walsingham, 1914: 358. Partim – 1 ♂, 1 ♀ only. Misidentification.]

ADULT (Figs 27–29). ♂, 18, 19 mm; ♀, 16 mm. Coloration and external structure similar to *bimendella* and *luctuosa* but antennal cilia 1·3 × (♂) flagellar diameter (antennae of ♀ broken). Forewing pattern similar to *luctuosa* but pale costal spots larger, resembling more those of *bimendella*, but suffused with purple-brown as in *luctuosa*; female with purple-brown fascia extended towards tornus, reaching posterior margin and extending into fringe.

GENITALIA ♂ (Fig. 93). Saccus shallowly triangular; uncus lobes very short, widely separated, but fused basally to form a kidney-shaped complex, each with pendulous setose ventral lobe bearing shallow subapical triangular process; uncus lobes setose but strongly sclerotized. Tegumen produced caudally to form pair of lateral triangular blunt-tipped processes. Subscaphium not developed. Juxta, if present, fused with valvae and not recognizable; transtilla possibly represented by thickened band across diaphragma between bases of valvae. Valva simple, lobate, apex with strong internal ridge terminating in shallow pyramidal process. Aedeagus stout, 8 × as long as broad at middle, without carinae; vesica with numerous strong spicular cornuti.

GENITALIA ♀ (Fig. 150). Eighth tergite longer than eighth sternite, with three pairs of strong subapical setae and a few scattered pits in posterior half; eighth sternite with lamellate surface and only slightly sclerotized dorsal to ostium, ventral lip of ostium m-shaped, lobes each bearing one pair of large setae and numerous small setae. Antrum with nodular/microtrichiate internal surface, terminating in colliculum well beyond margin of eighth sternite. Ductus bursae short, thin-walled, inception of ductus seminalis at junction with corpus bursae. Corpus bursae elongately pyriform, sparsely microtrichiate just anterior to inception of ductus seminalis, with strongly sclerotized subequatorial band bearing numerous dense and strong spicular signa arranged in two opposed inverted T-shaped clusters; membrane adjacent to these clusters with regular honeycomb-like reticulation.

DISTRIBUTION. (?)Guatemala; Colombia; Bolivia.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 3 ex.

Holotype ♂, **Bolivia**: Yungas de la Paz, 1908 (*Seebold*) (genitalia slide no. 12393; BMNH) (paralectotype of *luctuosa*).

Paratype. **Colombia**: 1 ♂, La Crumbre, 6600′, v.1914 (*P.*) (genitalia slide no. 12391; BMNH).

Excluded from paratype series. **Guatemala**: 1 ♀, Alta Vera Paz, Sinanja, x.1879 (*Champion*) (genitalia slide no. 13128; BMNH) (paralectotype of *luctuosa*).

REMARKS. Externally very similar to *bimendella*, *beckeri* and *luctuosa*, *mackiei* has shorter antennal cilia in the male than *bimendella* or *beckeri* although it has a large basicostal spot on the forewing similar to that in

bimendella. This spot is, however, suffused with brown whereas it is pure white in *bimendella*. The male genitalia are distinctive in having a pointed saccus, stout valvae with pyramidal apical processes, and the tegumen with triangular laterocaudal processes with rounded apices. The female, provisionally placed here, is distinguished by the elegant arrangement of spicular signa in a pair of opposed T-shaped clusters at the mid-length of the corpus bursae.

Meyrick originally identified the paratype of this species in his collection as 'Cranaodes bimendella Z.'.

Daviscardia bicolorella sp. n.

(Figs 30, 94)

Adult (Fig. 30). ♂, 17, 18 mm. Coloration and external structure similar to *bimendella* but frons whitish with a few brown lateral scales; entire inner surface of labial palpus whitish; antennal flagellum pale buff; cilia only 1·0 × flagellar diameter. Forewing purple-brown with very broad posterior and terminal cream fascia, tinged with orange-brown on dorsum and with some scattered brown scales in terminal fascia. Hindwing slightly greyish cream, some darker grey flecks at apex; mid-leg light grey-brown above and on outer surface of tibia, pale at articulations, tibia with oblique pale band on outer surface at one-half; outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·6 length of inner spur.

Genitalia ♂ (Fig. 94). Saccus triangular but rounded apically, with vinculum and tegumen forming a distinctly elongate genital armature; uncus lobes small, widely separated, strongly sclerotized, forming ventrally-directed lobe with strongly setose inner surface. Tegumen extended laterocaudally to form pair of sharp, spine-like processes. Subscaphium present, narrow, only slightly sclerotized. Juxta, if developed, fused with valvae and not recognizable, but possibly forming hemicylindrical process between valvae; transtilla hardly sclerotized but represented by thickened diaphragma forming a rigid cowl-shaped structure dorsal to valvae. Valva simple, apex ridged and sinuate. Aedeagus slender, about 20 × as long as broad at middle, without carinae; vesica with four or five short sagittate cornuti.

Genitalia ♀. Unknown.

Distribution. Bolivia.

Biology. Unknown.

Material examined. 2 ex.

Holotype ♂, **Bolivia**: Cochabamba (Yunga del Espiritu Santo), 1888–9 (*Germain*) (genitalia slide no. 13121; BMNH).

Paratype. 1 ♀, data as holotype (BMNH).

Remarks. This species, while superficially similar to *bimendella*, *beckeri*, *luctuosa* and *mackiei*, is distinguished by its short antennal cilia, glossy and markedly contrasting forewing fasciae with very little brown speckling in the pale fascia, lack of pale costal spots, and its uniformly pale-coloured frons and vertex. The male genitalia are distinguished by the elongate genital armature, sharp-tipped and horn-like laterocaudal tegumen processes (somewhat similar to those of *beckeri*), and by the hemicylindrical ventral structure (?juxta) between the bases of the valvae. This is the only species of *Daviscardia* that has a long and narrow aedeagus with only a few cornuti. All other species have an aedeagus about 10 times as long as broad and with numerous spicular cornuti. *D. bicolorella* has an aedeagus about 20 times as long as broad with only four or five small cornuti.

Daviscardia species A

(Fig. 95)

Adult. ♂, 18 mm. Vertex and frons light ochre. Labial palpus dark brown, apex ochreous. Antennal cilia 2·0 × flagellar diameter. Thorax and tegula dark brown anteriorly, whitish posteriorly. Forewing pattern similar to that of *bimendella* but without pale costal spots; distal half and terminal area of continuous pale fascia strongly flecked with purple-brown, strong spot at apex of R_4. Hind wing light grey. Outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·75 length of inner spur.

Genitalia ♂ (Fig. 95). Saccus shallow, rounded; uncus lobes widely separated, but fused basally, each forming shallow caudal and slightly longer ventral setose lobe. Tegumen extended laterocaudally to form two pairs of digitate processes. Subscaphium ribbon-like, ill-defined. Juxta, if developed, fused with valvae and not recognizable; transtilla possibly developed as a broadly triangular region of thickened membrane.

Valva ridged on internal surface, spatulate, with truncated apex. Aedeagus stout, about 10 × as long as broad at middle, with subapical group of numerous spicular carinae; vesica with numerous strong spicular cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. Mexico.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Mexico: 1 ♂, Oaxaca, km 140 on highway 175, 4000′, 22.v.1969 (*Howden*) (UC).

REMARKS. This species may be distinguished from all other *Daviscardia* by its having two processes from each corner of the tegumen rather than one. Superficially, it resembles *bimendella* and its allies but, like *bicolorella*, *radulella* and *lupulella* (and, possibly, *hypocritella*), the head vestiture is coloured uniformly. *D. bicolorella* has whitish head vestiture but the present species, *radulella, lupulella* and *hypocritella* have the frons and vertex a light shade of ochre. This species may be separated from *radulella* (the only one of these species of which the male is known) by its longer antennal cilia (twice the flagellar diameter in this species but only as long as the flagellar diameter in *radulella*).

Daviscardia lupulella sp. n.

(Figs 31, 149)

[*Phycis luctuosa* Walsingham, 1914: 358. Partim – 1 ♀ only. Misidentification.]

ADULT (Fig. 31). ♀, 23 mm. Vertex and frons light orange-brown (but very worn). Labial palpus brown, paler on inner surface. Maxillary palpus brownish grey, 3-segmented, but longer than in preceding species, almost reaching apex of second segment of labial palpus. Antennal scape, pedicel and flagellum dark brown but scape and distal region of flagellum ochreous above; cilia 0·7 × flagellar diameter. Thorax and tegula dark brown in anterior half, light orange-brown posteriorly. Forewing purple-brown with ill-defined and slightly paler costal spots at one-third and two-thirds; with brownish cream terminal and posterior fascia strongly tinted posteriorly and basally with orange-brown; strong dark spot at apex of R_4; further smaller spots on apices of M_1, M_2 and M_3; pale fascia sparsely flecked with purple-brown scales; posterior margin of purple-brown fascia with shallowly V-shaped medial emargination. Hind wing grey. Foreleg and mid-leg grey-brown, darker above, pale at articulations (hind legs missing); outer mid-tibial spur 0·5 length of inner spur.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 149). Eighth tergite longer than eighth sternite, with three or four pairs of strong subapical setae and numerous terminal and subterminal pits; eighth sternite smooth dorsal to ostium, ventral lip of ostium m-shaped, lobes each bearing one pair of large setae and numerous small setae. Antrum with nodular/microtrichiate internal surface, strongly sclerotized but not forming a colliculum anteriorly, terminating well beyond anterior margin of eighth sternite. Inception of ductus seminalis at apex of antrum. Corpus bursae elongately pyriform, posterior region thin-walled, appearing finely reticulate under phase-contrast; strongly wrinkled in a coarse reticular pattern and thick-walled medially; anteriorly very thin-walled; signa absent.

DISTRIBUTION. Panama.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♀, **Panama**: Volcan de Chiriqui, 2000–3000′, 1881 (*Champion*) (genitalia slide no. 12392; BMNH) (paralectotype of *luctuosa*).

REMARKS. This and the following species, *hypocritella*, are distinctive in that they are large and plain-patterned (and probably glossy-looking when fresh). The coloration of the head vestiture is uniform. The maxillary palpus is more elongate in this than in other *Daviscardia* species and the pale forewing fascia is more strongly tinted with orange-brown. The genitalia are distinctive in that there is an elongate, strongly sclerotized antrum and, as in *hypocritella*, no sclerotization of the ductus bursae. The m-shaped ventral lip of the ostium is similar to that seen in *luctuosa* and *mackie*; but quite unlike that of *hypocritella* which is almost transverse and with a deep and narrow medial emargination.

Daviscardia hypocritella sp. n.

(Figs 32, 151)

ADULT (Fig. 32). ♀, 24 mm. Coloration and external structure similar to preceding species, but coloration of head, thorax and legs uncertain, owing to covering of fungal hyphae. Forewing with whitish fascia paler; distal margin of purple-brown fascia slightly concave, turned at right-angles close to tornus, posterior margin only slightly concave medially, otherwise nearly straight; posterior fascia only slightly tinted with orange-brown on dorsum; pale fascia sparsely flecked with purple-brown scales; purple-brown spot at apex of R_4 only.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 151). Eighth tergite longer than eighth sternite, with four pairs of strong subapical setae, a few terminal pits and a pair of small setae; eighth sternite with terminal ostium, almost square-ended, ventral lip of ostium with deep and narrow medial emargination; posterior margin with two pairs of elongate strong setae and numerous smaller setae. Antrum short, hardly sclerotized, internal surface nodular/microtrichiate, apex forming a strongly sclerotized colliculum, its apex level with anterior margin of eighth sternite. Ductus bursae elongate, lined with sparse microtrichia, finely reticulate close to corpus bursae if observed under phase-contrast (×250); inception of ductus seminalis at one-fifth posteriorly. Corpus bursae spherical, posterior half thick-walled with strong transverse wrinkles; signa absent.

DISTRIBUTION. Panama.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♀, **Panama**: Chiriqui, 1899 (*R.*) (genitalia slide no. 13125; BMNH).

REMARKS. The pale forewing fascia of this species is not as strongly spotted with dark brown nor as strongly suffused posteriorly with orange-brown as in *lupulella*. The genitalia are distinctive and markedly different from those of the four other species of *Daviscardia* of which the female is known. The elongate ductus bursae and spherical corpus bursae are peculiar to *hypocritella*, and it is the only *Daviscardia* species in which the ventral lip of the ostium is not even approximately m-shaped.

The holotype of this species was originally identified by Meyrick in his collection as 'Cranaodes bimendella Z.' along with the present paratype of *mackiei*.

SCARDIA Treitschke

Scardia Treitschke, 1830: 291. Type-species: *Phycis boleti* Fabricius, 1798: 463, by subsequent designation by Busck, 1914: 65.

Agarica Sodoffsky, 1837(6): 20 (93). Type-species: *Phycis boleti* Fabricius, 1798: 463. [Unnecessary objective replacement name for *Scardia* Treitschke.]

Fernaldia Grote, 1881: 274. Type-species: *Fernaldia anatomella* Grote, 1881: 274, by monotypy. **Syn. n.**

Duomitella Koshantschikov, 1923: 22. Type-species: *Duomitella relicta* Koshantschikov, 1923: 23, by monotypy. [Synonymized by Zagulajev, 1973: 83.]

DIAGNOSIS. Antenna (male) lacking dorsal cilia, ventral surface without scales; cilia shorter than 1·5 × flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; pattern consisting of pale termen and dorsum on darker ground-colour. Male with coremata in eighth abdominal segment; coremata not associated with apodemes. Male genitalia with complex uncus fused with tegumen; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae + juxta fused ventrally into a single movable complex, valvae without longitudinal cleft; saccus wider than long; juxta complex, conspicuous, entire, not divided medially; vesica with spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

CONSPICUOUS AUTAPOMORPHIES. Uncus fused with bases of valvae, with pair of elongate horn-like internal processes; female with frenulum of about 15 strong bristles.

DISTRIBUTION. Western and eastern Palaearctic region; Oriental region – NE. India, Borneo; Nearctic region; Neotropical region – Venezuela.

Biology. See under entries for individual species.

Key to species of *Scardia*

Males (males of *alleni* are unknown)

1 Uncus lobes elongate, tapered, conspicuous 2
– Uncus lobes very short, inconspicuous 4

2 Tegumen extended caudally, dorsal to uncus lobes, forming a cowl-shaped process (Fig. 98). (eastern Palaearctic region) ..... ***amurensis*** (p. 89)
– Tegumen with U-shaped medial emargination, membrane within emargination bearing strong setae. (western Palaearctic region) 3

3 Costa of valva with shallow flap at three-quarters; apex of valva with U-shaped emargination (Figs 99, 100). (Europe east to Siberia, south to Yugoslavia) ..... ***boletella*** (p. 90)
– Costa of valva lacking shallow flap; apex of valva only slightly concave. (Caucasus) ***caucasica*** (p. 92)

4 Uncus lobes each with pair of thorn-like processes; two groups of strong dorsal setae associated with uncus lobes – setae elongate, extending well beyond processes of uncus lobes (Fig. 96). (Nearctic and (?)Neotropical regions) ..... ***anatomella*** (p. 87)
– Uncus lobes reduced to a pair of small pads, lacking processes; single medial group of setae associated with uncus lobes – setae short, not extending beyond finger-like lateral projections of tegumen (Fig. 97). (NE. India) ..... ***assamensis*** (p. 88)

Females (females of *assamensis* are unknown)

1 Ventral lip of ostium with deep medial emargination at least as deep as wide 2
– Ventral lip of ostium hardly or only shallowly emarginate medially, emargination wider than deep 4

2 Ventral lip of ostium with deep, narrow medial emargination many times deeper than wide (Fig. 154). (eastern Palaearctic region) ..... ***amurensis*** (p. 89)
– Ventral lip of ostium with V-shaped emargination no more than twice as deep as wide 3

3 Ventral lip of ostium with emargination as deep as wide (Fig. 155). (Europe east to Siberia, south to Yugoslavia) ..... ***boletella*** (p. 90)
– Ventral lip of ostium with emargination deeper than wide (Fig. 156). (Caucasus) ..... ***caucasica*** (p. 92)

4 Ventral lip of ostium shallowly concave; pair of shallow, lateral, keel-like processes on eighth sternite bearing elongate, apical setae (Fig. 153). (Nearctic and (?)Neotropical regions) ***anatomella*** (p. 87)
– Ventral lip of ostium with broad, U-shaped emargination; eighth sternite without keel-like processes, elongate setae scattered near ventral margin of ostium (Fig. 152). (Borneo) ***alleni*** (p. 90)

Scardia anatomella (Grote) **comb. rev.**

(Figs 33, 34, 96, 153)

Fernaldia anatomella Grote, 1881: 274; Davis, 1983: 5. LECTOTYPE ♀, U.S.A. (BMNH), here designated [examined].

Scardia fiskeella Busck, 1908: 93. Holotype ♀, U.S.A. (NMNH) [examined]. [Synonymized by Davis, 1983: 5.]

Scardia anatomella (Grote) Walsingham, 1882: 171; Dyar, [1903]: 568; Dietz, 1905: 24; McDunnough, 1939: 104.

Adult (Figs 33, 34). ♂♀, 20–34 mm. Coloration and external structure similar to *boletella* but antennal cilia only 0·4 × (♀) flagellar diameter and distal segments of antenna light brown. Forewing with little or no orange-brown scaling on veins; in specimen from Venezuela (Fig. 34) cream markings not as strongly speckled with brown as in *boletella*; cream markings at posterior margin reduced in several examples.

Genitalia ♂ (Fig. 96). Saccus broad, shallow; uncus lobes very short and reduced, highly modified, with elongate and spine-like dorsal processes and shallow, dentate dorsal ridge, setae few, restricted to mediodorsal region. Caudal margin of juxta-tegumen complex strongly emarginate, with four pairs of strong spines arising from fused base at dorsocaudal margin of each uncus lobe. Subscaphium not

developed. Juxta U-shaped, with further inverted U-shaped sclerotization within the 'U', fused laterally with valvae, extended distally into pair of claw-shaped processes; transtilla not developed. Valva with ventral margin strongly angled outward, apical margin strongly emarginate and with shallow subapical flap running obliquely across ventrocaudal region, with weak medial longitudinal ridge and with shallow triangular process close to costa at one-half. Aedeagus tapered, simple, 4 × as long as broad at base, apex obliquely truncated; vesica with a few scattered minute spicular cornuti (microtrichia) close to inception of ductus ejaculatorius (i.e., at apex of vesica when everted).

GENITALIA ♀ (Fig. 153). Eighth tergite slightly longer than eighth sternite, inverted shield-shaped anterior region strongly sclerotized, posterior quarter almost membranous but with five pairs of strong submarginal setae and numerous smaller setae, these scattered almost to mid-length of tergite; eighth sternite folded to form strongly sclerotized posterior lobe overlying deep pocket (a 'false antrum'), then folded again ventrally and slightly anteriorly to form pair of shallowly triangular lobes only slightly sclerotized mesally and forming lateral margins of ostium; lobes each with three strong setae and four or five smaller setae. Anterior margin of ostium membranous and ill-defined; sternite deepened dorso-ventrally at anterior end to accommodate antrum. Antrum ill-defined, slightly tapered anteriorly, extending slightly beyond anterior margin of eighth sternite; inception of ductus seminalis close to anterior end of antrum. Ductus bursae slightly less than one-half length of apophyses anteriores, thin-walled. Corpus bursae elongately ovoid, thin-walled except for posterior third which is apparently thicker and more heavily-staining, reaching 1·3 length of apophyses anteriores; signa absent.

DISTRIBUTION. U.S.A. (New York – Grote, 1881; North Carolina – Busck, 1908; Louisiana; Arkansas; Oregon – Walsingham, 1882; California – Powell, [1968]; Florida – Kimball, 1965; Pennsylvania – Forbes, 1923; Illinois, Texas, Utah – Dietz, 1905); Canada (Ontario – Forbes, 1923); Venezuela.

BIOLOGY. Described by Walsingham (1882) who bred several specimens from larvae collected in Oregon in March. The larvae were boring round holes in a fallen dead pine tree.

MATERIAL EXAMINED. 14 ex., 5 pupae.

Lectotype ♀ (of *anatomella*) (abdomen missing), **U.S.A.**: New York (*Grote*) (BMNH). Holotype ♀ (of *fiskeella*), **U.S.A.**: North Carolina, Tryon, 8.vii.1904 (*Fiske*) (genitalia slide no. 18664; NMNH).

U.S.A.: 9 ex., Oregon, Grant Co., Camp Watson, in dead wood (pine), coll. iii, em. vi.1872 (*Walsingham*) (genitalia slide nos. 19195, 12389, 12390; BMNH); 1 ♂, Louisiana, 1884 (*Morrison*) (BMNH); 1 ♀, Arkansas, Hope, vi.1926 (BMNH). **Venezuela**: 1 ♂ (ex Felder coll.) (BMNH).

REMARKS. The only New World species of *Scardia, anatomella* is characterized by the genitalia of both sexes: in the male the uncus lobes are short and modified into spine-like processes; the female genitalia differ from other *Scardia* in that the triangular membranous lobe dorsal to the ostium is lacking, as in *amurensis*, and the eighth sternite has a conspicuous and strongly sclerotized posterior margin that is dorsal to the ostium. This strongly developed posterior region also occurs in *amurensis* but in that species it is deeply cleft and overlaid (in ventral view) by a pair of lateral processes directed caudally and extending beyond this posterior and dorsal region of the sternite.

The specimen from Venezuela is from the Felder collection. It may be labelled incorrectly. It is lighter and with a more strongly marbled appearance to the forewings than specimens from the U.S.A.: this is due to the lack of brown speckling within the cream forewing markings, and the comparatively larger pale costal spots.

I am unable to resolve convincingly the phylogeny of the six *Scardia* species. *S. boletella* and *caucasica* are clearly sister-species, their sister-group being *alleni* (synapomorphy: membranous triangular lobe overlying ostium dorsally). The sister-group of *boletella* + *caucasica* + *alleni* is probably *amurensis* (synapomorphy: elongate and tapered uncus lobes). The precise relationship of this grouping to *anatomella* and *assamensis*, which retain the short, squat uncus complex also observed in *Daviscardia*, the probable sister-group of *Scardia*, is uncertain. However, the uncus lobes in *anatomella* are almost completely separated from the tegumen by membrane whereas in all other *Scardia* species they are almost completely fused; the degree of separation observed in *anatomella* is similar to that observed in *Daviscardia* and is considered to be the ground-plan state of the character. On the basis of this decidedly weak feature, *anatomella* is the sister-group of all other *Scardia*.

Scardia assamensis sp. n.

(Figs 35, 97, 101)

ADULT (Fig. 35). ♂, 24 mm. Coloration and external structure similar to *boletella* but frons and vertex dark

reddish brown, thorax and tegula deep purple-brown. Forewing (worn) lacking extensive pale posterior fascia, with only scattered whitish scales close to posterior margin; pale markings of terminal fascia silver-grey, not as extensive as in *boletella*. Hindwing fringe not chequered.

GENITALIA ♂ (Figs 97, 101). Saccus broad, shallow; uncus lobes short, apices short and digitate and widely separated, strongly sclerotized and with setae restricted to laterodorsal region. Fused uncus-tegumen complex strongly emarginate medially, membrane of emargination bearing conspicuous group of about 40 strong spines. Subscaphium not developed. Juxta trapezoidal, fused laterally with valvae, extended distally to form pair of hand-shaped processes; transtilla not developed. Valva simple, with small shallow hook-like process at apex. Aedeagus stout, about 5 × as long as broad at base, strongly sclerotized, apex laterally emarginate; vesica with scattered minute spicular cornuti (microtrichia) for half its length closest to inception of ductus ejaculatorius (i.e., in apical half of vesica if it were everted).

GENITALIA ♀. Unknown.

DISTRIBUTION. India – Assam.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♂, **India**: Assam, Khasi Hills, Cherrapunji, v.1895 (*native collector*) (genitalia slide no. 1514; BMNH).

REMARKS. This is the only Old World *Scardia* species in which the lobes of the uncus are short. *S. assamensis* is small; it lacks the extensive pale fascia at the posterior margin of the forewing that characterizes other *Scardia* with the exception of *alleni*. It is the only species in which the head, thorax and tegulae are entirely dark brown and the only one in which the horn-like lateral processes from the juxta are modified and hand-shaped, bearing small digitate subterminal processes.

Scardia amurensis Zagulajev

(Figs 36, 98, 154)

Scardia amurensis Zagulajev, 1965: 411; 1973: 96; Moriuti, 1982: 163. Holotype ♂, U.S.S.R. (ZI) [examined]
[(?) *Scardia boletella* (F.); Caradja, 1939: 111. Misidentification.]
[*Scardia boletella* (F.); Issiki, 1957: 16. Misidentification.]

ADULT (Issiki, 1957: pl. 2, fig. 46 (colour); Moriuti, 1982: pl. 2, fig. 12 (♀), pl. 227, fig. 1 (♂) (colour); Fig. 36). ♂♀, 39–42 mm. Coloration and external structure similar to *boletella*.

GENITALIA ♂ (Zagulajev, 1965: fig. 1; Zagulajev, 1973: figs 15B, 16b, 75; Moriuti, 1982: pl. 248, figs 10, 10a; Fig. 98). Saccus broad, shallow; uncus lobes flattened laterally, strongly sclerotized, setose, tapered to a point; tegumen extended dorsocaudally to form overlying triangular process, spined membranous dorsal recess thus absent. Subscaphium not developed but membrane of diaphragma in this region forming shallow lateral pockets with transverse wrinkling. Juxta quadrate, fused laterally with valvae, extended distally into pair of claw-like processes, with doubly bulbed shallow ventral process; transtilla not developed. Valva almost square, simple, costa extended caudally in a simple, rounded extension that is bulbous subapically; slight basal ridge on internal surface of valva close to patch of about 10 short, strong setae. Aedeagus 5 × as long as broad at base, explanate apically, planarian-shaped; vesica with minute spicular cornuti (microtrichia) close to inception of ductus ejaculatorius (i.e., at apex if vesica were everted).

GENITALIA ♀ (Zagulajev, 1973: figs 76, 77; Fig. 154). Eighth tergite slightly longer than eighth sternite, inverted shield-shaped anterior region strongly sclerotized, posterior quarter almost membranous but with five pairs of strong submarginal setae and numerous smaller setae; eighth sternite strongly folded to form pair of lateral setose digitate processes, each overlying a cushion-shaped lobe; ostium a deep fold behind these cushion-like lobes, ventral margin a narrow bridge between them. Course of antrum complex, oriented dorso-ventrally through base of cushion-like lobes then turned anteriorly and forming a colliculum-like apex just anterior to margin of eighth sternite; inception of ductus seminalis apparently close to inner bases of cushion-like lobes (i.e., remarkably posterior). Ductus bursae very thin-walled, one-half length of apophyses anteriores, with fine and numerous irregular transverse constrictions. Corpus bursae ovoid, very thin-walled, reaching 1·3 length of apophyses anteriores; signa absent.

DISTRIBUTION. U.S.S.R. – Amur and Primorsk regions; (?) China (Caradja, 1939); Japan.

BIOLOGY. Specimens have been collected on the trunk of a rotting tree and bred from larvae living in fungus (Zagulajev, 1973); the Japanese specimen examined (see below) was bred from *Fomes fomentarius*.

MATERIAL EXAMINED. 10 ex.

Holotype ♂, **U.S.S.R.**: Primorsk Terr., Spassk-Dalniy, at light, 5.viii.1950 (*Zagulajev*) (ZI).

U.S.S.R.: 1 ♂ (paratype), Amur Prov., Svobodnyi Dist., Simonovo vill., at light, 1.viii.1959 (*Falkovitsh*) (ZI); 1 ♂ (paratype), Primorsk Terr., Suchan, on trunk of rotting tree, 16.viii.1950 (*Zagulajev*) (ZI); 1 ♀, Ussuri, Kaimanovka vill., 28–31.vii.1964 (*Tsvetayev*) (ZI); 1 ♂, 1 ♀, Suputinskiy Reserve, bred from larva in fungus, 14.v.1967 (*Mamaev*) (BMNH; ZI); 2 ♀, Ussuri Railway, Chabarovsk, 14.vii.1910 & 23.vii.1911 (*Borsow*) (BMNH); 1 ex., data not recorded (ZI). **Japan**: 1 ♂, Ehime Pref., Mt Sara, bred from *Fomes fomentarius*, em. 8.v.1954 (*Hisamatsu*) (genitalia slide; coll. S. Moriuti, Osaka).

REMARKS. The wing-pattern of this species and the morphology of the male genitalia are very similar to those of *boletella* (see 'Remarks' for that species) and *caucasica*. The female genitalia, however, are markedly different, lacking the triangular membranous lobe dorsal to the ostium and having the eighth sternite conspicuously modified as described above.

Caradja's record of 'boletella' from China, probably referable to this species, has not been confirmed by examination of the original specimen.

Scardia alleni sp. n.

(Figs 37, 152)

ADULT (Fig. 37). ♀, 31 mm. Coloration and external structure similar to *boletella* but frons and vertex brownish yellow, maxillary palpus dark purple-brown, thorax cream, tegula dark purple-brown. Forewing with pale markings almost obliterated by dark purple-brown, a few silvery white scales close to posterior margin at one-half; terminal fascia composed of discrete silvery white spots not speckled with brown as in *boletella*. Hindwing charcoal grey, a few slightly paler flecks towards apex, fringe not chequered.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 152). Eighth tergite slightly longer than eighth sternite, with four pairs of elongate, strong setae close to posterior margin, and with a few scattered minute thorn-like setae; eighth sternite separated by membranous sutures into roughly triangular mediocaudal and lateral sclerites; mediocaudal region rugose, posterior margin strongly concave, with five pairs of strong setae and numerous smaller setae; ostium overlain dorsally by triangular membranous lobe, wall of ovipositor dorsal and slightly posterior to apex of lobe ballooned ventrad to form pair of shallow lobes. Antrum very short, conical, sclerotized strongly at anterior end and forming a colliculum-like constriction. Ductus bursae thick-walled, with strong and regular transverse constrictions on inner surface (this apparent restriction to the inner surface may be an artefact caused by separation of the outer layer of the membrane of the ductus). Corpus bursae contiguous with ductus, elongately ovoid, reaching 1·5 length of apophyses anteriores; signa absent.

DISTRIBUTION. Borneo – Brunei.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.

Holotype ♀, **Brunei**: Labi, lowland forest, 60 m, 12.i.1980 (*Allen*) (genitalia slide no. 1517; BMNH).

REMARKS. Of the six *Scardia* species, *alleni* is the darkest, the pale terminal and posterior fasciae of the forewing being markedly reduced in comparison with the other species. The hindwing is distinctively darker than in the other species. The genitalia resemble those of *boletella* and *caucasica* in that there is a triangular membranous lobe dorsal to the ostium, but the ventral margin of the ostium lacks the deep U- or V-shaped invagination of these species and the membranous lobe lacks a terminal sclerite.

The locality in which the holotype was collected is on the Rampayoh River in an area of low hills forested with typical lowland dipterocarp forest (Allen, pers. comm.).

Scardia boletella (Fabricius) nom. rev.

(Figs 38, 99, 155)

[*Phalaena (Tinea) gigantella* [Denis & Schiffermüller]; Hübner, 1790: 38, pl. 2(2), fig. F. Misidentification.]

Tinea boletella Fabricius, 1794: 287. LECTOTYPE (?) ♀, [Austria or Sweden], (ZM), here designated [examined].

Phycis ‡*boleti* Fabricius, 1798: 463. Unjustified emendation of *boletella*.

Noctua polypori Esper, [1804]: pl. 196, fig. 1; [1805]: 64. Unnecessary objective replacement name for *Phycis boleti* F., 1798 (cited as 'Tinea Boleti') which is an unjustified emendation of *Tinea boletella* F., 1794.

Duomitella relicta Koshantschikov, 1923: 23. Syntypes, 1 ♂, 1 ♀, U.S.S.R. (ZI) [examined]. [Synonymized by Zagulajev, 1973: 89.]

Adult (Hübner, 1796: pl. 3, fig. 18; Esper, [1804]: pl. 196, fig. 1; Zagulajev, 1973: figs 31, 32, 66, pl. 2, fig. 1; Fig. 38). ♂♀, 37–60 mm. Vertex and frons brownish cream, brown close to eyes. Labial palpus cream, brown on outer surface of first and second segment and in middle of third segment. Maxillary palpus cream flecked with brown. Antennal scape, pedicel and flagellum dark brown; cilia 1·2 × (♂) or 0·7 × (♀) flagellar diameter. Thorax cream flecked with brown; tegula brown, cream posteriorly. Forewing cream, strongly patterned with dark purple-brown, with orange-brown on veins; cream coloration almost obliterated by brown and restricted to termen and posterior margin, with a few pale flecks towards costa; fringe conspicuously chequered. Hind wing light grey-brown, pale flecks towards apex; fringe chequered. Legs cream, strongly flecked with brown but pale at articulations; outer mid-tibial spur 0·6 length of inner; outer proximal hind tibial spur 0·7 length of inner spur.

Genitalia ♂ (Petersen, 1957: fig. 238; Zagulajev, 1973: figs 14B, 67; Fig. 99). Saccus broad, shallow; uncus lobes flattened laterally, strongly sclerotized, setose and tapered to a point; tegumen with dorsal emargination bearing five or six pairs of strong spines; dorsal region of fusion of uncus lobes and tegumen broad, with shallow lateral invaginations. Subscaphium not developed, but membrane in this region with lateral patches of lamellate microtrichia. Juxta broadly V-shaped, fused laterally with valvae, extended distally into pair of horn-shaped processes; transtilla not developed. Valva simple but with shallow and rugose costal flap and with mediobasal fold; apical margin with broadly U-shaped emargination. Aedeagus 10 × as long as broad, strongly sclerotized but simple; vesica with minute spicular cornuti (microtrichia) close to inception of ductus ejaculatorius (i.e. at apex if vesica were everted).

Genitalia ♀ (Petersen, 1957: fig. 239; Zagulajev, 1973: figs 68, 69; Fig. 155). Eighth tergite slightly longer than eighth sternite, with slightly concave caudal margin, with four pairs of strong marginal setae at posterior corners and seven or eight pairs of smaller submarginal setae; eighth sternite oval, strongly keeled, ventral margin of ostium V-shaped, with small medial emargination; lobes either side of ostium each bearing six stout setae and a few smaller setae; ostium surmounted by membranous posteriorly-extended lobe bearing elongate heart-shaped sclerite with shallow lateral invaginations; posterior to lobe and sclerite a deep anteriorly-directed pocket forming a 'false antrum'. Antrum hardly sclerotized, tapered anteriorly, reaching anterior margin of eighth sternite; inception of ductus seminalis just anterior to colliculum-like apex of antrum. Ductus bursae one-half length of apophyses anteriores, with irregular transverse constrictions, very thin-walled. Corpus bursae ovoid, very thin-walled, reaching 1·3 length of apophyses anteriores.

Distribution. Norway (Aarvik & Midtgaard, 1982); Sweden (Petersen, 1957); Finland (Jalava, 1977); U.S.S.R. – Baltic and European regions, Crimea, Siberia (Zagulajev, 1973); West Germany (Petersen, 1968); Czechoslovakia (Petersen, 1965); Hungary (Petersen, 1957); Rumania; Austria (Petersen, 1957); Switzerland (Rebel, 1901); Italy (Petersen & Gaedike, 1979); Yugoslavia.

Biology. See Zagulajev (1973: 93) – bred from *Fomes*, *Ganoderma* and *Polyporus*. Zagulajev (1973: figs 20, 22, 26, 27) illustrates the larva. The biology is also described briefly by Mitterberger (1910: 171) and Koshantschikov (1923). The latter author found three live pupae enclosed in webbed frass on fungi on a dead birch, and he also found three large larvae (which he preserved) in the fungus.

Material examined. 54 ex., 4 pupae.

Lectotype (?)♀ (of *boletella*) (abdomen missing), [**Austria** or **Sweden**]: labelled 'boleti' in Fabricius' hand (Sehested & Tonder Lund collection, ZM).

Syntypes (of *relicta*), **U.S.S.R.**: Siberia, Irkutsk, Minussinsk dist., Sajan Mts, Tiberkul Lake: 1 ♂, 21.vii., 1 ♀, 17.vii.1920 (*Koshantschikov*) (ZI).

37 ex., 4 pupae (ZI) and 15 ex. (BMNH), various localities (see 'Distribution' and Zagulajev (1973)).

Remarks. Esper expressly proposed the name *polypori* as a replacement name for 'Tinea Boleti' which he considered preoccupied by *Noctua boleti* F., 1777.

This species is one of the largest Tineidae and has a wide but sporadic boreo-alpine/cold temperate

distribution in the western Palaearctic region, occurring in montane localities as far south as Italy and Yugoslavia. It may be separated from all other *Scardia* by the genitalia, characteristic in both sexes but very similar indeed to those of *caucasica*; the latter species represents an isolated geographical race of *boletella* only arguably deserving of specific status. With *caucasica, boletella* may be separated from all other *Scardia* by the elongate and pointed lobes of the uncus in the male and by the triangular membranous lobe that overlies the ostium of the female and terminates in a laterally invaginated sclerite. The only other *Scardia* with pointed uncus lobes is *amurensis* (although they may also occur in *alleni* when the male of that species is discovered) in which the tegumen forms a shallow triangular hood above the uncus lobes (the tegumen is emarginate in *boletella* and *caucasica*) and in which the apex of the aedeagus is conspicuously explanate. *S. alleni* has a similar membranous lobe overyling the ostium in the female but the lobe is not sclerotized at its apex. The pronounced allopatry of the *Scardia* species is helpful in identification although further collecting may show the presently disjunct distributions to be artefactual.

Scardia caucasica Zagulajev

(Figs 39, 100, 156)

Scardia caucasica Zagulajev, 1965: 412, figs 2, 3. Holotype ♂, U.S.S.R. (ZI) [examined].

ADULT (Zagulajev, 1973: fig. 70; Fig. 39). ♀, 44 mm. Coloration and external structure similar to *boletella*.

GENITALIA ♂ (Zagulajev, 1965: figs 3, 19; 1968: fig. 16; 1973: fig. 72; Fig. 100). Similar to *boletella* but dorsal margins of uncus lobes not extended as far caudally (in lateral view); dorsal region of tegumen narrow, with deep lateral indentations; valva with costal flap hardly developed, apical margin only shallowly concave.

GENITALIA ♀ (Zagulajev, 1965: fig. 2; 1968: fig. 17; 1973: fig. 73; Fig. 156). Similar to *boletella* but eighth tergite with only three pairs of large setae and two or three pairs of small setae; ventral margin of ostium deeper, V-shaped; lobes either side of ostium more elongate, each with four strong setae arranged in a diagonal line at one-half, smaller setae concentrated at apex. Lobe dorsal to ostium broader and shorter, with dome-shaped terminal sclerite with small, deep lateral invaginations.

DISTRIBUTION. U.S.S.R. – Caucasus.

BIOLOGY. Zagulajev (1973) collected a male of this species on a fungus-infested ash trunk.

MATERIAL EXAMINED. 10 ex., 4 pupae.

Holotype ♂, **U.S.S.R.**: Caucasus, Georgia, Lagodekhi, 8.viii.1961 (*Zagulajev*) (ZI).

U.S.S.R.: Caucasus: 1 ♂, Tbilisi dist., Manglis, 13.ix.1882 (*Christoph*) (ZI); 1 ♀, 4.viii.1891 (*Hedemann*) (ZI); 1 ♀, Lagodekhi, 1888 (*Mlokosevitch*) (ZI); 2 ♂, 3 ♀, Lagodekhi, wet forest in lower zone of reserve, 27–30.vii and 8.viii.1961 (*Zagulajev*) (ZI; 1 ♀ in BMNH) (all paratypes); 1 ♂, Armenia, Idzfrevanskiy dist., 30 km from Sevkar, Kerants Monastery, on fungus-infested ash trunk at dusk, 31.vii.1960 (*Zagulajev*) (ZI).

REMARKS. For differentiation of this species from *boletella*, see above; see also 'Remarks' for *boletella*.

PERILICMETIS Meyrick

Perilicmetis Meyrick, 1932*b*: 323. Type-species: *Perilicmetis diplaca* Meyrick, 1932*b*: 324, by monotypy.

DIAGNOSIS. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia shorter than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus with fewer than 5 segments; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_3 and CuA_1 stalked or very closely approximated at base; light grey speckled with dark brown, with broad, dark brown, oblique subterminal fascia. Male with coremata in eighth abdominal segment; coremata without associated apodemes. Male genitalia with complex uncus fused with tegumen; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica lacking spicular cornuti; aedeagus with spicular or spinose carinae.

CONSPICUOUS AUTAPOMORPHIES. Forewing with oblique dark brown subterminal fascia constricted in middle to form a pair of large, narrowly connected spots; remainder of forewing light grey, finely speckled with dark brown.

Distribution. Neotropical region – Brazil.

Biology. Unknown.

Perilicmetis diplaca Meyrick

(Figs 40, 102, 180)

Perilicmetis diplaca Meyrick, 1932*b*: 324. LECTOTYPE ♂, Brazil (NM), here designated [examined].

Adult (Figs 40, 180). ♂, 17–22 mm. Vertex and frons chocolate brown. Labial palpus chocolate brown, outer surface of third segment darker. Maxillary palpus buff, dark brown above, 4-segmented, short, reaching only basal one-sixth of second segment of labial palpus. Antennal scape buff, large dark brown spot above; pedicel dark brown; flagellum pale buff; cilia 0·8 × flagellar diameter. Thorax and tegula greyish white flecked with dark brown anteriorly. Forewing greyish white, strongly flecked with dark brown; conspicuous oblique subterminal fascia formed from pair of large dark brown spots. Hindwing very pale greyish brown, whitish towards base. Legs pale buff; foreleg and mid-leg strongly marked with dark brown above and on sides but pale at articulations; hind tarsus banded with brown; outer mid-tibial spur 0·45 length of inner; outer proximal hind tibial spur 0·5 length of inner spur.

Genitalia ♂ (Fig. 102). Saccus triangular; uncus lobes separated, strongly fused with tegumen, tapered and divergent apically, well-sclerotized, setose. Subscaphium not developed. Juxta represented by only slight ventral thickening of anellus; transtilla not developed. Valva elongate, broad, simple, apex forming slight dorsal hook. Aedeagus 8 × as long as broad, somewhat flattened dorsoventrally, with dense spinose carinae on ventral surface; vesica without cornuti.

Genitalia ♀. Unknown.

Distribution. Brazil.

Biology. Unknown.

Material examined. 7 ex.
Lectotype ♂, **Brazil**: Santa Catharina, Neu Bremen, 23.ii.1931 (*Hoffmann*) (NM).
Brazil: 2 ♂, (paralectotypes) Santa Catharina, Jaragua, 24.viii.1929, 16.ix.1930 (*Hoffmann*) (BMNH; NM); 1 ♂, São Paulo (*Jones*) (BMNH); 1 ♂, Parana, Castro, x.1895 (*Jones*) (BMNH); 1 ♂, Santa Catharina, Neu Bremen, 2.ix.1936 (*Hoffmann*) (genitalia slide no. 6966; BMNH); 1 ♂, Santa Catharina, 18.iii.1936 (*Hoffmann*) (BMNH).

Remarks. The external appearance of this species is very distinctive, the wing-pattern being unlike that of any other tineid known to me. Although the specimens examined are old and probably faded, the forewing ground-colour is distinctly greyish. The only other scardiines that could be thought of as greyish are the *Amorophaga* species. The genitalia of *Perilicmetis* resemble superficially those of *Amorophaga* but the valva is much more simple and the tegumen is complete dorsally.

MOSCARDIA gen. n.

Type-species: *Myrmecozela renitens* Meyrick, 1922*b*: 591.

Diagnosis. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia shorter than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus 5-segmented in *renitens* but probably with fewer (four or three) segments in *varna*; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; pattern consisting of pale termen and dorsum on darker ground-colour. Male with coremata in eighth abdominal segment; coremata associated with short, lobe-like apodemes at anterior corners of eighth sternite. Male genitalia with complex uncus fused with tegumen; tegumen unbroken, completely sclerotized dorsally (but broken dorsally by a membranous suture line in *renitens*); valva lacking basal setose lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica lacking spicular cornuti; aedeagus with spicular or spinose carinae.

Conspicuous autapomorphies. None; however, males of *Moscardia* species may be recognized externally by their brown forewing with pale apex and dorsum and completely scaled antenna with short cilia;

exclusive microscopic characters are the short apodemes of the eighth sternite in combination with minute microtrichia on the second sternite.

DISTRIBUTION. Neotropical region – Brazil, Bolivia.

BIOLOGY. Unknown.

Key to species of *Moscardia* (only males are known)

1 Tegumen broken by dorsal line of membrane, without processes; uncus lobes strongly sclerotized and with serrate subapical ridge ..... ***renitens*** (p. 94)
– Tegumen complete dorsally, strongly sclerotized, with pair of small lanceolate caudal processes; uncus lobes almost membranous, apices rounded (Fig. 104) ..... ***varna*** (p. 95)

Moscardia renitens (Meyrick) comb. n.

(Fig. 41)

Myrmecozela renitens Meyrick, 1922*b*: 591. Holotype ♂, BRAZIL (BMNH) [examined].

ADULT (Clarke, 1970: pl. 32, fig. 3; Fig. 41). ♂, 22 mm. Vertex and frons pale whitish ochre, frons strongly tinted reddish brown. Labial palpus very dark brown on outer surface but cream at articulation between second and third segments and at tip; inner surface light brown on second segment, cream on third. Maxillary palpus short, not as long as second segment of labial palpus, but probably 5-segmented, dark brown. Antennal scape and pedicel cream, flecked with light brown; flagellum brownish cream, darker brown on basal few segments; cilia 0·8 × (♂) flagellar diameter. Thorax and tegula medium brown, whitish posteriorly. Forewing badly rubbed; traces of pattern present only at margins, brownish cream flecked with light brown, strongly spotted with dark brown at costa and with strong dark brown spot on posterior margin at two-thirds. Hindwing light greyish brown with slight purple iridescence. Legs cream flecked with brown; foreleg and mid-leg strongly marked with dark brown above and on sides but pale at articulations, outer surface of mid-tibia with broad oblique whitish band; outer mid-tibial spur 0·5 length of inner spur [hind legs missing].

GENITALIA ♂ (Clarke, 1970: pl. 32, figs. 3a, 3b). Saccus elongate, triangular, almost as long as valva; uncus lobes triangular, strongly sclerotized, fused with tegumen but with incomplete membranous suture forming line of flexion, with serrate subapical ridge. Subscaphium apparently not developed (but preparation poor). Juxta apparently large and shield-shaped (but preparation damaged in this area and difficult to interpret); transtilla apparently not developed. Valva simple, with small setose lobe on costa at three-quarters and with three small peg-like apical processes; membranous subapical suture on outer surface. Aedeagus stout, 5 × as long as broad, asymmetrical, with three strong, subapical horn-shaped carinae directed caudally, and with three similar but smaller anteriorly-directed carinae closer to apex; vesica without cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. Brazil.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♂, **Brazil**: Teffe, i.1920 (*Parish*) (genitalia slide no. JFGC 6653; BMNH).

REMARKS. The condition of the holotype of this species, and of the slide of its genitalia, is such that description of the forewing pattern and of the juxta/transtilla/subscaphium region is not possible. Despite this, the genitalia are characterized simply by the structure of the uncus lobes and the valva. *M. renitens* differs from *varna* in that the maxillary palpus of the latter, while as long as that of *renitens*, has apparently only three segments. In *varna* the tegumen is strongly sclerotized and unbroken dorsally and the uncus lobes are almost membranous; the tegumen is produced caudally to form a pair of small, rhomboidal processes. In *renitens* the tegumen is broken dorsally by a zone of membrane, the uncus lobes are strongly sclerotized, and there are no processes from the tegumen.

There is no trace of a pattern of pale apex and dorsum on the forewings of the holotype of *renitens*. Although the specimen is very rubbed, I would have expected to find traces of such a pattern, had one been present. It is possible, therefore, that this species and *varna* have quite different forewing patterns.

Moscardia varna sp. n.

(Figs 42, 104)

[*Phycis luctuosa* Walsingham, 1914: 358, partim – 1 ♂ only. Misidentification.]

ADULT (Fig. 42). ♂, 17 mm. Vertex and frons brownish cream. Labial palpus dark brown on outer surface, paler on inner surface and at apex. Maxillary palpus short, not as long as second segment of labial palpus, probably 4- or 3-segmented, dark brown. Antennal scape and pedicel dark brown above; flagellum light grey-brown; cilia 1·0 × (♂) flagellar diameter; (thorax obscured by glue). Tegula medium brown. Forewing deep purple-brown, with continuous golden brown posterior and terminal fascia occupying more than half of total wing area; scales close to junction with deep brown anterior fascia pale gold, increasing the contrast between the two. Hindwing dark grey. Legs greyish-ochreous (worn and damaged).

GENITALIA ♂ (Fig. 104). Saccus elongate, triangular; uncus lobes small, inturned ventrad, almost membranous, setose, surmounted by strongly sclerotized tegumen with pair of small rhomboidal mediocaudal processes. Subscaphium not developed. Juxta represented only by slight thickening of anellus; transtilla not developed. Valva elongate, twice length of saccus, extending well beyond apices of tegumen lobes; simple, with small and shallow triangular lobe bearing 6 small setae at two-thirds of costa; apex of valva rounded, with spinose setae. Aedeagus stout, 6 × as long as broad, with, either side, subapical group of two triangular basally-directed carinae; vesica without cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. Bolivia.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.

Holotype ♂, **Bolivia**: Yungas de la Paz, 1908 (*Seebold*) (genitalia slide no. 13122; BMNH) (paralectotype of *Phycis luctuosa* Walsingham).

REMARKS. See 'Remarks' for *renitens* for differentiation from that species. The external appearance of *varna*, with strongly developed, continuous and extensive distal and posterior fasciae on the forewing, is characteristic: the posterior pale fascia extends further anteriorly than in any other species dealt with here. The aedeagus is only lightly sclerotized and has suffered slight damage during preparation. The anellus has been torn and has peeled back the wall of the aedeagus from close to the carinae. Interpretation is therefore difficult but there appear to be a pair of elongate, sinuate processes that originally commenced as ridges at the base of the aedeagus and reached the apices of the (backward-directed) carinae. These are now folded backward from close to the base of the aedeagus and lie within a fold of the anellus.

GENTINGIA gen. n.

Type-species: *Gentingia hollowayi* sp. n.

DIAGNOSIS. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus with fewer than 5 segments; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 stalked or very closely approximated at base; M_2, M_3 and CuA_1 separate; ground-colour very pale bronze, with pattern of small purple-brown marginal spots and larger costal blotch. Male with coremata in eighth abdominal segment; coremata without associated apodemes. Male genitalia with complex uncus fused with tegumen; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae fused ventrally, without longitudinal cleft; saccus longer than wide; juxta, if present, fused with valvae and not recognizable as such; vesica with spicular cornuti; aedeagus with spicular or spinose carinae.

CONSPICUOUS AUTAPOMORPHIES. Male with tegumen produced laterocaudally into pair of hooked processes; female with scobinate signum surrounding inception of ductus bursae in corpus bursae; interior surface of ductus bursae denticulate anteriorly, posteriorly with overlapping scale-like plaques.

DISTRIBUTION. Oriental region – Malay Peninsula, Borneo.

BIOLOGY. Unknown.

Gentingia hollowayi sp. n.

(Figs 43, 103, 157, 184)

ADULT (Figs 43, 184). ♂♀, 16–19 mm. Vertex and frons pale yellow-brown. Labial palpus ochreous, strongly suffused with brown on outer surface but pale at apex and articulations. Maxillary palpus whitish, flecked with dark brown above, short, apparently 3-segmented. Antennal scape and pedicel ochreous, flecked above with dark brown; flagellum light greyish ochreous, with darker scales basidorsally; cilia 1·5 × (♂) or 0·5 × (♀) flagellar diameter. Thorax and tegula cream, strongly flecked anteriorly with dark brown. Forewing pale golden, strongly spotted with dark purple-brown along costa and termen; strong wedge-shaped dark blotch from costa across end of cell to *CuP*; conspicuous (but frequently abraded) dark spot on middle of dorsum. Hindwing off-white. Legs ochreous cream, foreleg and mid-leg dark brown above; outer mid-tibial spur and outer hind proximal tibial spur 0·6 length of inner spurs.

GENITALIA ♂ (Fig. 103). Saccus triangular, strongly tapered anteriorly; uncus lobes short, small, strongly sclerotized, curved ventrad, burin-shaped, setose, entirely fused with tegumen; tegumen with pair of lateral hook-shaped processes. Subscaphium not developed. Juxta, if present, entirely fused with valvae and not recognizable; transtilla not developed. Valvae strongly fused ventrally to form single movable unit; medioventrally with an m-shaped projecting caudal margin, overlying this a medial thimble-shaped process; apices of valvae rounded, dorsal to the medial structures and extending caudally beyond them; inner margins of valvae emarginate at level of m-shaped process; ventral surface of valva smooth, apically and dorsally with numerous setae, dorsal margin (costa) hardly sclerotized but with line of about six strong setae. Aedeagus tapered, 12 × as long as broad in middle, with lateral bands of thorn-like carinae from one-half to apex; vesica with minute blunt lepidote cornuti (?microtrichia).

GENITALIA ♀ (Fig. 157). Eighth tergite considerably longer than eighth sternite, with two subapical pairs of elongate strong setae, three or four pairs of smaller setae at posterior corners, and with scattered pits in caudal half; eighth sternite triangular, deeply pocketed laterally, apex with V-shaped emargination interrupted by keel-like mediocaudal process with bilobed tip, each lobe bearing pair of elongate strong setae and a few small setae. Antrum broad, funnel-shaped posteriorly then tubular and slightly asymmetrical, meeting ductus seminalis at two-thirds anteriorly, reaching 0·75 length of apophyses anteriores, anterior end strongly microtrichiate, microtrichia extending into ductus bursae. Ductus bursae very thick-walled, internal surface strongly lepidote, the scale-like surface projections arranged in a regular transverse pattern giving the appearance of very fine regular constrictions under low-powered magnification; lepidote projections highly developed anteriorly, resembling sharks' teeth, and continuous with denticles of signum. Corpus bursae thin-walled, with U-shaped denticular signum surrounding inception of ductus bursae.

DISTRIBUTION. Malay Peninsula; Borneo (Fig. 200).

BIOLOGY. Unknown.

MATERIAL EXAMINED. 3 ex.

Holotype ♂, **West Malaysia**: W. Pahang, Genting Highlands, *ca* 4400′, 23.xi.1981 (*Tuck*) (genitalia slide no. 9479; BMNH).

Paratypes. **Sarawak**: 1 ♂, Mt Dulit, R. Koyan, 2500′, primary forest, river-bank vegetation, 18.xi.1932 (*Hobby & Moore*) (BMNH); 1 ♀, Gunung Mulu National Park, G. Mulu site 14 – camp 2.5, G.R. 413461, 1000 m, lower montane forest, at m.v. light in canopy or understorey, ii.1978 (*Holloway et al.*) (genitalia slide no. 9482; BMNH).

REMARKS. This taxon is distinctively patterned and structurally atypical. The wing-pattern strongly resembles that of *Semeoloncha* from West Africa and there are genital similarities in the male, notably in the structure of the tegumen and uncus lobes. The valvae of the two genera are very different, however, *Semeoloncha* having a pair of separated soft, lobate, strongly setose valvae with an extraordinary process from the modified apodeme. Both genera have an atypically-shaped saccus and both have a tapered aedeagus; however, the aedeagus is smooth-surfaced in *Semeoloncha* but with numerous thorn-like carinae in *Gentingia*. The female genitalia of *Semeoloncha* are unknown; however, the genitalia of *Gentingia* differ from those of all other Scardiinae in the peculiar shape of the eighth sternite and in the presence of a single U-shaped denticulate signum at the point of inception of the ductus bursae on the corpus bursae.

SEMEOLONCHA Gozmány

Semeoloncha Gozmány, 1968: 332. Type-species: *Semeoloncha penicillata* Gozmány, 1968: 324, by original designation and monotypy.

Diagnosis. Antenna (male) with dorsal cilia, ventral surface scaled; cilia shorter than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_3 and CuA_1 stalked or very closely approximated at base; ground-colour very pale bronze, with pattern of small, purple-brown marginal spots and larger costal blotch. Male with coremata in eighth abdominal segment; coremata associated with short, lobe-like apodemes at anterior corners of eighth sternite. Male genitalia with complex uncus fused with tegumen; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica with spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

Conspicuous autapomorphies. Male with eighth tergite reduced, narrow and rod-like, broadening anteriorly, thus T-shaped. Coremata very large, recessed as far as anterior margin of seventh segment; apodeme of valva with strong, arcuate dorsal process arising at one-third from apodeme base and directed caudally.

Distribution. Afrotropical region – Sierra Leone.

Biology. Unknown.

Semeoloncha penicillata Gozmány

(Fig. 44)

Semeoloncha penicillata Gozmány, 1968: 334. Holotype ♂, Sierra Leone (BMNH) [examined].
Semeoloncha penicillata Gozmány; Gozmány & Vári, 1973: 152, fig. 460.

Adult (Fig. 44). ♂, 20 mm. Vertex and frons whitish. Labial palpus whitish, strongly flecked with brown on outer and upper surfaces of first and base of second segment. Maxillary palpus cream, flecked above with brown, short, 5-segmented, not reaching one-half length of second segment of labial palpus. Antenna cream; cilia 0·25 × (♂) flagellar diameter. Thorax and tegula cream, slightly darker anteriorly. Forewing very pale golden or straw-coloured (probably very faded) with small light brown marginal spots, these merged to form a terminal line between R_4 and M_3; larger conspicuous spots just beyond one-half on costa and subtornally. Hindwing pale greyish cream with inconspicuous brown blotches on apical margin. Legs cream; fore-tibia and fore-tarsus marked above with brown but conspicuously pale at articulations; outer mid-tibial spur and outer proximal hind tibial spur 0·7 length of inner spurs.

Genitalia ♂ (Gozmány, 1968: figs 46–48; Gozmány & Vári, 1973: fig. 460). (For description of the caudal region of the abdomen, see 'Remarks'.) Saccus diamond-shaped, almost as long as tegumen + uncus; uncus lobes entirely fused with and subsumed into tegumen, possibly forming the setose caudal margin; tegumen + uncus cowl-shaped, with strongly melanized horn-like lateral processes. Subscaphium not developed. Juxta not developed but anellus swollen to form irregular and microtrichiate lobe at base of each valva; transtilla not developed. Valvae closely appressed (but not fused) basally, lobate, setose; apodemes extraordinarily elongate, each with long and arcuate caudally-directed spike arising from dorsal surface two-thirds from apex. Aedeagus tapered, stout, 7 × as long as broad in middle; apex extended as a narrow tapering band of sclerotization; vesica with minute spicular cornuti (?microtrichia).

Genitalia ♀. Unknown.

Distribution. Sierra Leone.

Biology. Unknown.

Material examined. 2 ex.
Holotype ♂, **Sierra Leone**: vii.1895 (*Clements*) (genitalia slide no. 14997; BMNH).
Sierra Leone: 1 ♂ (paratype), data as holotype but v.1895 (genitalia slide no. 15008; BMNH).

Remarks. When examined originally, both genitalia preparations of this species (only two specimens are known) were very poor. The basal three abdominal segments of the holotype remained attached to the

specimen but the remainder of the abdomen had been thrown away, leaving only the badly compressed genitalia and aedeagus on the slide. In the case of the paratype, the terminal two abdominal segments only had been retained; these were damaged and contorted, making the structure impossible to interpret. The genital armature was so badly crushed that it had split longitudinally down the tegumen. Like the holotype, it was grossly overstained. It was thus impossible to determine the structure of the subscaphium, juxta or transtilla, or to code enough information for inclusion of *Semeoloncha* in the numerical analyses. Remounting of both preparations after rehydration, cleaning and differentiating clarified the structure of the diaphragma and details of the seventh and eighth segment. The eighth sternite is broad and the coremata are set in the sternite rather than in the pleural membrane: the dorsal margin of the coremata invagination is strengthened, forming the lateral margin of a dorsal triangular complex consisting of sternite (lateral and outer anterior margins), tergite (medial rod-shaped structure with expanded anterior end) and pleural membrane (region with small spiracle either side of rod-like tergite). This extraordinary structure and the extreme modification of the valval apodeme serve to distinguish *Semeoloncha* from all other scardiine taxa.

CRANAODES Meyrick

Cranaodes Meyrick, 1919: 238. Type-species: *Cranaodes stereopa* Meyrick, 1919: 239, by monotypy.

Diagnosis. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; ground-colour pale bronze, with pattern formed of large purple-brown blotches (but ground-colour paler and blotches more extensive in *oroya*). Male with coremata in eighth abdominal segment; coremata associated with short, lobe-like apodemes at anterior corners of eighth sternite. Male genitalia with complex uncus fused with tegumen; tegumen broken dorsally by at least a membranous suture line; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica lacking spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

Conspicuous autapomorphies. Forewing pattern consisting of bold purple-brown patches on a pale bronze ground-colour (except in *oroya*).

Distribution. Neotropical region – Colombia, Panama, Peru; Oriental region – Borneo.

Biology. Unknown.

Key to species of *Cranaodes*

Males (males of *sequestrata* are unknown)

1 Dark markings of forewing divided by broad antemedial band of ground-colour (Fig. 45); valva with densely setose medial digitate process on inner surface; costa and ventral margin of valva simple ..... ***stereopa*** (p. 98)
– Dark markings of forewing continuous through antemedial region (Fig. 46); inner surface of valva without process; costa and ventral margin of valva strongly folded (Fig. 106).... ***oroya*** (p. 99)

Females (females of *oroya* are unknown)

1 Dark costal blotch on forewing broad, extending posteriorly to middle of cell (Fig. 47); ventral lip of ostium convex (Fig. 159). (Borneo)..... ***sequestrata*** (p. 100)
– Dark costal blotch on forewing narrow, not extending further posteriorly than base of R_5 (Fig. 45); ventral lip of ostium with U-shaped emargination (Fig. 158). (Neotropical region) ***stereopa*** (p. 98)

Cranaodes stereopa Meyrick

(Figs 45, 158)

Cranaodes stereopa Meyrick, 1919: 239. Holotype ♂, Colombia (BMNH) [examined].

Adult (Clarke, 1970: pl. 17, figs 2, 2a, 2b; Fig. 45). ♂, 27 mm; ♀, 40 mm. Vertex and frons brownish yellow. Labial palpus cream, brownish on outer surface, slender, not strongly tufted on second segment.

Maxillary palpus cream, flecked with brown above, relatively short, reaching only about one-half length of second segment of labial palpus. Antennal scape and pedicel light grey-brown; cilia 1·7 × (♂) or 0·5 × (♀) flagellar diameter. Thorax and tegula light yellow-brown, strongly flecked with dark brown anteriorly. Forewing pale bronze marked with strong purple-brown blotches forming a broken irregular postmedial band; quadrate basal blotch continuous with strong basicostal blotch; numerous smaller costal spots. Hindwing light brownish grey. Legs buff, foreleg and mid-leg dark brown above but paler at articulations and across middle of mid-tibia; outer mid-tibial spur 0·6 length of inner; outer hind proximal tibial spur 0·7 length of inner spur.

Genitalia ♂ (Clarke, 1970: pl. 17, figs 2c, 2d). Saccus triangular; uncus lobes entirely fused with outer corners of tegumen, each forming a setose and strongly sclerotized knob-like protuberance with a pair of small apical spines. Subscaphium not developed. Juxta quadrate, strongly sclerotized, transtilla not developed. Valva plain, with strong and setose medial digitate process, apodeme with shallow dorsally-directed flap. Aedeagus stout, 10 × as long as broad in middle, sclerotization of apex a thin tapered process only, ventrally with distinctive subbasal longitudinal 'keel'.

Genitalia ♀ (Fig. 158). Eighth tergite longer than eighth sternite, with three pairs of strong epimarginal setae and numerous scattered (?)microsetae; eighth sternite with broad terminal ostium with strong V-shaped emargination of ventral lip; margin of eighth sternite either side of ostium with compact group of four elongate setae and numerous smaller setae. Antrum short, broadly funnel-shaped, inception of ductus seminalis posterior to anterior margin of eighth sternite. Ductus bursae thick-walled, inner surface rugose, rugosity with distinct transverse pattern that becomes transverse wrinkling further anteriorly. Corpus bursae thin-walled, elongately ovoid; signa absent.

Distribution. Panama; Colombia.

Biology. Unknown.

Material examined. 2 ex.
Holotype ♂, **Colombia**: San Antonio, 5800′, xi.1907 (genitalia slide no. JFGC 6645; BMNH).
Panama: 1 ♀, Chiriqui (genitalia slide no. 13109; BMNH).

Remarks. This is one of the largest and most striking Tineidae, its characteristic wing-pattern serving to distinguish it from all other Neotropical species. Similarities to *sequestrata* may be entirely the result of convergence; however, in the absence of further material of *sequestrata* (particularly males) any discussion as to whether or not the two species are really congeneric would be conjectural. They differ in the length of the (female) antennal cilia, in the shape and size of the forewing markings and in the genitalia, *stereopa* having a strong U-shaped emargination of the ventral lip of the ostium (= posterior margin of eighth sternite) and *sequestrata* having a slightly convex margin with considerably more strong and elongate setae than *stereopa*. In both species the ductus bursae has fine transverse wrinkling (= regular constrictions) but in *stereopa* this is represented posteriorly by rugosity with a distinctive transverse pattern. This latter feature may represent the unexpanded state of the ductus prior to copulation and the ductus may assume a regularly constricted form after being expanded. There is a marked difference between the two species in the form of the wall of the ovipositor dorsal to the ostium: in *sequestrata* this wall is ballooned ventrally to form a lobe large enough to close off the ostium, whereas in *stereopa* the ovipositor wall is quite smooth. Similar swellings of the ovipositor wall occur in most Scardiinae but they are not always conspicuous nor, in theory, capable of closing over the ostium (there is no evidence that this is the function of these lobes).

The function and homology of the flap from the valval apodeme of the male of *stereopa* is uncertain. Similar but much more elongate processes are found in *Semeoloncha*. Apodemal processes also occur in the poorly-known genus *Leptozancla* (Robinson, 1976); this is probably also a scardiine taxon but the material available is in such condition as to make precise placement impossible. The apodemal processes of these groups are analogous to some of the modifications of the labides that occur in *Tinissa* (Robinson, 1976) although probably not homologous.

Cranaodes oroya sp. n.

(Figs 46, 106)

Adult (Fig. 46). ♂, 26 mm. Coloration and external structure of head similar to *stereopa*. Thorax brownish cream, a few darker scales anteriorly; tegula grey-brown, a few pale scales at margins. Forewing pale bronze (but badly faded) strongly marked with dark brown to form a possibly continuous anterior fascia similar to that of *Daviscardia* species (but specimen very worn); paler spots along costa; conspicuous pale round spots at end of cell and at end of fold. Hindwing light grey-brown. Legs buff, foreleg and mid-leg

darker above (very worn); outer mid-tibial spur 0·7 length of inner; outer proximal hind tibial spur 0·75 length of inner spur.

GENITALIA ♂ (Fig. 106). Saccus elongately triangular; uncus lobes similar to those of *stereopa* but forming only a very small pair of hook-shaped processes on the outer corners of the tegumen. Subscaphium not developed. Juxta represented only by ill-defined thickening of anellus; transtilla not developed. Valva with strongly folded costa and ventral margin, otherwise plain, apodeme without flap (but flap of *stereopa* may represent initial development or reduction of costal fold of this species). Aedeagus almost cylindrical, 10 × as long as broad in middle, with triangular membranous zone from base to almost one-third and with similar but shorter zone from apex.

GENITALIA ♀. Unknown.

DISTRIBUTION. Peru.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♂, **Peru**: R. Inambari, La Oroya, 3100′, dry season, ix.1904 (*Ockenden*) (genitalia slide no. 12394; BMNH).

REMARKS. Smaller and with much more extensive dark forewing markings than *stereopa*, *oroya* may also be distinguished by the male genitalia in which the costa and ventral margin of the valva are strongly folded inward. The flap from the valval apodeme of *stereopa* is absent in *oroya* but may form a part of the costal fold. The middle of the valva bears a conspicuous setose digitate process in *stereopa* but is smooth in *oroya*. Although the wing pattern of the two species is strongly divergent, the similarities of the male genitalia (notably in the complex of the uncus lobes plus tegumen) suggest that they are congeneric.

Cranaodes sequestrata Meyrick

(Figs 47, 159, 200)

Craneodes [sic] *sequestrata* Meyrick, 1926: 164. Holotype ♂, SARAWAK (SM, Kuching) [not found – probably destroyed].

ADULT (Robinson, 1984: pl. 6, fig. 4; Fig. 47). ♀, 32 mm. Vertex and frons yellow-brown. Labial palpus pale buff, strongly speckled with dark brown on outer surface, apex pale. Maxillary palpus grey-brown, reaching only about one-half length of second segment of labial palpus. Antennal scape and pedicel pale buff, flecked with dark brown; flagellum pale buff; cilia 1·0 × flagellar diameter. Thorax and tegula off-white, strongly flecked with grey-brown anteriorly, thorax almost entirely dark. Forewing light greenish bronze flecked with pale brown; large quadrate dark brown spot from costa to posterior margin of cell at one-half; basal half of costa flecked with dark brown; dorsum strongly flecked with dark brown (but worn); a few small dark spots at apex and termen. Hindwing pale greyish buff. Legs pale buff; foreleg and mid-leg darker above, mid-tibia with pair of large diffuse blackish spots above; outer mid-tibial spur 0·5 length of inner; outer proximal hind tibial spur 0·6 length of inner spur.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 159). Eighth tergite longer than eighth sternite, with four pairs of strong terminal setae and numerous scattered smaller lateral setae; eighth sternite forming a protruding ledge that accommodates ostium behind its posterior margin; sternite with 10 pairs of elongate setae and a few smaller setae close to caudal margin. Antrum narrow and cylindrical, ostium closed by bulbous protrusion of ovipositor wall; inception of ductus seminalis just posterior to anterior margin of eighth sternite. Ductus bursae elongate, thin-walled, but with fine and close-set transverse wrinkles, extending beyond apices of apophyses anteriores. Corpus bursae thin-walled, elongately ovoid; signa absent.

DISTRIBUTION. Borneo (Fig. 200).

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Brunei: 1 ♀, Bukit Pagon, LP 308, 5520′, upper montane forest, 15–20.ii.1982 (*Robinson*) (genitalia slide no. 6981; BMNH).

REMARKS. The female specimen described here agrees well with Meyrick's original description of the male: discrepancies are in the colour of the head ('greyish ochreous'), the ground-colour of the forewing

('prismatic white') and the absence of any mention of dark markings on the dorsum. It is unlikely that Meyrick's holotype of this species, deposited originally in the Sarawak Museum, Kuching, still exists. Exhaustive searches at my request by the present curators (and by workers in the 1950s – Diakonoff, pers. comm.) have failed to turn up any of the material described in Meyrick's 1926 paper. I am reasonably confident that the female described here is of Meyrick's species. On the basis of the characters available from this female there is no reason to exclude *sequestrata* from *Cranaodes*. However, the genitalia do differ substantially from those of *stereopa* (q.v.) and the similarities may be entirely due to convergence.

PECTINISCARDIA gen. n.

Type-species: *Cranaodes prostylias* Meyrick, 1927: 327.

Diagnosis. Antenna (male) with dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. Male genitalia with simple uncus – a pair of setose lobes – fused with tegumen; tegumen broken dorsally by at least a membranous suture line; valva lacking basal setose lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica with spicular cornuti; aedeagus damaged – presence of carinae uncertain.

Conspicuous autapomorphies. Ventrocaudal margin of valva with strong pectinifer of about 12 spines (this character is paralleled in *Morophaga formosana* and *iriomotensis*).

Distribution. Neotropical region – Colombia.

Biology. Unknown.

Pectiniscardia prostylias (Meyrick) comb. n.

(Fig. 48)

Cranaodes prostylias Meyrick, 1927: 327. Holotype ♂, Colombia (BMNH) [examined].

Adult (Clarke, 1970: pl. 17, figs 2b, 3; Fig. 48). ♂, 27 mm. Vertex and frons cream. Labial palpus cream, flecked on outer surface with brown (but very worn). Maxillary palpus cream flecked with brown, 5-segmented, short, reaching only one-fifth length of second segment of labial palpus. Antennal scape and pedicel pale buff, scape flecked strongly above with brown but distal third cream; pedicel and basal flagellar segments dark brown above; cilia 3·0 × flagellar diameter. Thorax and tegula worn and damaged. Forewing very worn, golden cream patterned with purple-brown; costa and fringe with conspicuous chequering. Hindwing pale cream (worn) with a few scattered darker scales at apex and termen. Legs (worn) pale buff; foreleg and mid-leg marked strongly above and on sides with brown but pale at articulations; mid-tibia with pale oblique medial bar on outer surface; outer mid-tibial spur 0·6 length of inner spur; hind tibial spurs broken.

Genitalia ♂ (Clarke, 1970: pl. 17, figs 3a, 3b). Saccus elongate, triangular, longer than tegumen + uncus; uncus lobes broad, square-ended. Subscaphium not developed. Juxta shield-shaped, hardly sclerotized; transtilla not developed. Valva an obliquely truncated rectangle, simple except for well-developed pectinifer of about 12 stout spines. Aedeagus 9 × as long as broad; apex damaged but with strong sickle-shaped subapical carina and at least a pair of smaller corniform carinae; vesica with minute spicular cornuti (microtrichia).

Genitalia ♀. Unknown.

Distribution. Colombia.

Biology. Unknown.

Material examined. 1 ex.

Holotype ♂, **Colombia**: Central Cordilleras, 11,800′, xi.1920 (genitalia slide no. JFGC 6646; BMNH).

Remarks. The holotype of this species is so worn that it is impossible to provide good external characteristics for its recognition. However, the alternated dark and light spots down the costa give it a chequered appearance and this feature is distinctive: it is not nearly so strongly developed in any other New

World scardiine. The forewing pattern is otherwise hard to discern. The apical fascia is certainly pale: the dorsum has lost almost all scales but was probably also pale and the remainder of the wing appears to have been mottled with dark brown. Fresh specimens might resemble *Morophagoides* species such as *iulina*. The male genitalia of *Pectiniscardia* are quite distinctive. A pectinifer is developed otherwise in the Scardiinae only in *Morophaga formosana* and *iriomotensis* and I believe this to be a clear case of convergence.

HORMANTRIS Meyrick

Hormantris Meyrick, 1927: 327. Type-species: *Hormantris astragalopa* Meyrick, 1927: 327, by monotypy.

Diagnosis. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers absent; second segment of labial palpus longer than width of head. Legs damaged – relative lengths of tibial spurs unknown. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. Male genitalia with simple uncus – a pair of setose lobes – separated from tegumen by narrow band of membrane; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica with spicular cornuti; aedeagus with spicular or spinose carinae.

Conspicuous autapomorphies. Ventral half of inner surface of valva with dense field of thorn-like setae.

Distribution. Neotropical region – Colombia.

Biology. Unknown.

Hormantris astragalopa Meyrick

(Fig. 49)

Hormantris astragalopa Meyrick, 1927: 327. Holotype ♂, Colombia (BMNH) [examined].

Adult (Clarke, 1970: pl. 29, figs 1, 1a, 1b; Fig. 49). ♂, 34 mm. Head and thorax almost entirely denuded but some white and brown scales on labial palpus. Maxillary palpus whitish, elongate, 5-segmented. Antennal scape and pedicel whitish with some brown scales; flagellum pale buff-cream; cilia about 8 × flagellar diameter. Forewing almost entirely denuded, pale buff-cream with scattered small brown speckles; slightly larger brown spots on costa; large subapical dark brown spot. Hindwing off-white mottled with pale grey. Foreleg buff strongly flecked with dark brown; other legs lost.

Genitalia ♂ (Clarke, 1970: pl. 29, figs 1c, 1d). Saccus broad, elongate and strongly sclerotized; uncus lobes small, digitiform, poorly sclerotized, sparsely setose. Subscaphium not developed. Juxta, if present, represented by only slight swelling of anellus; transtilla not developed. Valva almost circular, dorsal half strongly spined on internal surface; ventral margin with rounded triangular flap at one-half and with short, stout basal setose lobe. Aedeagus dumb-bell-shaped with dense spinose carinae on dorsal surface of apical half; vesica with group of eight spine-like cornuti.

Genitalia ♀. Unknown.

Distribution. Colombia.

Biology. Unknown.

Material examined. 1 ex.
Holotype ♂, **Colombia**: Mt Tolima, 12,500′, x.1920 (genitalia slide no. JFGC 6644; BMNH).

Remarks. *Hormantris* differs from *Cnismorectis* (q.v.) in having a more elongate maxillary palpus; the antennal cilia are considerably longer, the longest of any scardiine known. Unlike *Cnismorectis*, the ventral surface of the antenna is scaled and the pecten is sparse with, apparently, fewer than 15 bristles (but the specimen is worn and the bristle-sockets have not been checked in a microscopic preparation). The holotype of *astragalopa* is so worn as to make impossible any comparison of wing pattern except the observation that the subapical dark brown spot does not occur in *Cnismorectis*.

CNISMORECTIS Meyrick

Cnismorectis Meyrick, 1936: 109. Type-species: *Cnismorectis choritica* Meyrick, 1936: 109, by monotypy.

Diagnosis. Antenna (male) lacking dorsal cilia, ventral surface without scales; cilia longer than 1·5 × flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus with fewer than 5 segments; pilifers absent; second segment of labial palpus longer than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. Male genitalia with simple uncus – a pair of setose lobes – separated from tegumen by narrow band of membrane; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta complex, entire, not divided medially; vesica with spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

Conspicuous autapomorphies. Ventral margins of valvae invaginated, contiguous with juxta which is infolded anteriorly, the whole complex forming a deep, broad pocket; vesica with elongate oval of small, thorn-like cornuti.

Distribution. Neotropical region – Peru, Bolivia.

Biology. Unknown.

Cnismorectis choritica Meyrick

(Figs 50, 105, 160, 182)

Cnismorectis choritica Meyrick, 1936: 109. LECTOTYPE ♀, Bolivia (BMNH), here designated [examined].

Adult (Figs 50, 182). ♂♀, 26–36 mm. Vertex and frons very pale buff with a few dark scales. Labial palpus very pale buff flecked with brown. Maxillary palpus whitish, 4-segmented, very short, not reaching base of second segment of labial palpus. Antennal scape and pedicel ochreous cream flecked with brown, flagellum ochreous cream; cilia 3.0 × (♂) or 0.3 × (♀) flagellar diameter. Thorax and tegula very pale buff flecked with brown. Forewing cream flecked and finely strigulated with orange-brown (particularly along veins) and dark brown, dark markings concentrated to leave ill-defined paler ante- and postmedial fasciae. Hindwing dirty cream strigulated with pale grey. Legs pale buff strongly flecked with brown, particularly above on fore-leg and mid-leg; mid-tibia conspicuously rough-scaled; tarsi ringed with brown; outer mid-tibial spur 0.8 length of inner; outer proximal hind tibial spur 0.6 length of inner spur.

Genitalia ♂ (Fig. 105). Saccus slender, elongate; uncus lobes slender, small, only slightly sclerotized, setose. Subscaphium not developed. Juxta apparently forming ventral wall of pocket that extends anteriorly behind saccus and extends laterally into ventral margins of valvae; transtilla not developed. Valva almost rectangular with dorsal corner produced into a spatulate lobe; ventral margin invaginated to form conspicuous pocket; internal surface with coarse microtrichia and two or three small peg-like processes (?sensillae) at four-fifths. Aedeagus slender, elongate, 20 × as long as broad in middle, without carinae; base of vesica with elongate oval of small, thorn-like cornuti.

Genitalia ♀ (Fig. 160). Seventh sternite with corethrogyne of fine, elongate hairs. Eighth tergite slightly longer than eighth sternite, deeply emarginate medially, with two pairs of elongate terminal setae and five pairs of smaller terminal setae. Eighth sternite with deep U-shaped medial emargination accommodating ostium, with dense, stiff, elongate bristles. Antrum narrow, cylindrical, one-third length of apophyses anteriores. Ductus bursae thin-walled, as long as antrum; inception of ductus seminalis close to junction with antrum. Corpus bursae thin-walled, pyriform, twice length of antrum; signa absent.

Distribution. Bolivia, Peru.

Biology. Unknown.

Material examined. 5 ex.

Lectotype ♀, **Bolivia**: Santa Cruz, Samaipata, 1500 m, iii (*Steinbach*) (genitalia slide no. 6970; BMNH).

Bolivia: 1 ♀ (paralectotype), 1934 (*Staudinger*) (BMNH); 1 ♂, 1 ♀, Rio Tanampaya, 1894 (*Garlepp*) (genitalia slide no. 6969; BMNH). **Peru**: 1 ♀, Huanuco, Cushi, 1900 m (*Hoffmann*) (BMNH).

Remarks. *Cnismorectis* is the sister-group of *Hormantris*. The two are conspicuous in that they have a distinctive mottled pattern on the hindwings and exceptionally elongate labial palpi: both have lost the pilifers. In the male genitalia of both, the uncus lobes are very small and digitiform and the vesica has thorn-like cornuti. The microtrichia on the valva of *Cnismorectis* are, however, replaced functionally by a

field of very small thorn-like spines covering the dorsal half of the valva in *Hormantris*.

The relationship of these genera to *Dorata* Busck, a genus of five greyish cream species with plain hindwings from northern Mexico and south-western U.S.A., requires further investigation. Superficially, *Dorata* does not look like a scardiine but, like *Cnismorectis* and *Hormantris*, has elongate labial palpi and lacks pilifers. The uncus lobes are similar to those of *Cnismorectis* but bear strong, thorn-like spines. Similar spines occur on the dorsal lobe of the strongly bifurcated valva which also carries a setose digitate process from the ventral margin in the one species examined (*Dorata atomophora* Meyrick). The ventral lobe of the valva of *Dorata* may represent the juxta: a pouch superficially similar to that of *Cnismorectis* runs anteriorly from the ventral base of the valva. Davis (in prep.) is including *Dorata* in a revision of the North American Tineidae.

MINISCARDIA gen. n.

Type-species: *Scardia minimella* Busck, 1914: 65.

Diagnosis. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus with fewer than 5 segments; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate: M_3 and CuA_1 stalked or very closely approximated at base; mottled coloration forming cryptic, coarse 'moss' pattern. Male with coremata in eighth abdominal segment; coremata not associated with apodemes. Male genitalia with simple uncus – a pair of setose lobes – fused with tegumen; tegumen unbroken, completely sclerotized dorsally; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta, if present, simple, entire, not divided medially; vesica with spicular cornuti; aedeagus with spicular or spinose carinae.

Conspicuous autapomorphies. None; however, may be recognized by the exclusive combination of moss-like forewing pattern with veins M_3 and CuA_1 stalked or connate – see 'remarks' for *minimella*.

Distribution. Neotropical region – Panama, Costa Rica, Guatemala, Brazil; Nearctic region – U.S.A. (Arizona).

Biology. Unknown.

Miniscardia minimella (Busck) comb. n.

(Figs 55, 56, 111, 165)

Scardia minimella Busck, 1914: 65. Holotype ♂, Panama (NMNH) [examined].

Adult (Figs 55, 56). ♂, 15–19 mm. ♀, 20–25 mm. Vertex and frons orange-brown, with dark brown tufts close to eyes. Labial palpus orange-brown, strongly marked with deep purple-brown on outer surface. Maxillary palpus dull buff, deep purple-brown on upper and outer surfaces, probably 3-segmented, reaching only one-half length of second segment of labial palpus. Antennal scape and pedicel orange-brown, dark purple-brown above; flagellum scales light grey-brown but darker at base of flagellum; cilia 1·5 × (♂) or 0·2 × (♀) flagellar diameter. Thorax and tegula deep purple-brown, thorax with buff-cream transverse band, tegula tipped with buff-cream. Forewing buff-cream, strongly speckled with deep purple-brown, speckling concentrated into basal, medial and subterminal fasciae. All deep purple-brown markings (especially on underside) with pronounced blue-green iridescence when observed at an acute angle. Hindwing light brownish grey. Legs buff, foreleg and mid-leg heavily marked above and at sides with deep purple-brown, but pale at articulations; mid-tibia with pair of conspicuous oblique dark bars on outer surface; hindleg greyish above; outer mid-tibial spur 0·5 length of inner; outer hind proximal tibial spur 0·75 length of inner spur.

Genitalia ♂ (Fig. 111). Saccus elongate, triangular, more than half length of genital armature; uncus lobes triangular, fused with each other and with tegumen, sclerotized, setose, apices level with apices of valvae. Subscaphium not developed. Juxta not developed or represented only by ill-defined thickening of base of anellus; transtilla not developed. Valva slender, triangular, simple. Aedeagus 7 × as long as broad, with subapical dorsal transverse band of small, thorn-like carinae; vesica with minute spicular cornuti (?microtrichia).

Genitalia ♀ (Fig. 165). (Description based on examples from French Guiana and Brazil.) Eighth tergite

slightly longer than eighth sternite, with about 8 strong setae close to caudal margin and pair of large medial patches of microtrichia; eighth sternite with shallowly m-shaped caudal margin, strongly folded medially to accommodate broad, transverse ostium with convex or slightly concave ventral lip; apex of eighth sternite with two or three pairs of strong setae and numerous short, small setae. Antrum with broad posterior chamber, dorsal surface of chamber with dome-shaped thickening surrounding inception of ductus seminalis; anterior region of antrum a short, smooth-walled, narrow tube reaching less than 0·25 length of apophyses anteriores. Ductus bursae thick-walled posteriorly, with about 15 irregular transverse constrictions, becoming very thin-walled anteriorly. Corpus bursae globular, very thin-walled, extending to 1·25 length of apophyses anteriores; signa absent.

DISTRIBUTION. Guatemala; Costa Rica; Panama; French Guiana; Brazil.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 7 ex.

Holotype ♂, **Panama**: Porto Bello, v.1912 (*Busck*) (genitalia slide no. 20156; NMNH, Washington).

Guatemala: 1 ♂, Poptum, Peten, 15–16.ix.1973 (*Becker*) (coll. Becker, Brasilia). **Costa Rica**: 1 ♂, San Jose, 1922 (genitalia slide no. 12689; BMNH); 1 ♀, 1935 (*H.S.*) (genitalia slide no. 12680; BMNH). **French Guiana**: 1 ♀, Nouvelle Chantier, x. (*Le Moult*) (genitalia slide no. 12684; BMNH); 1 ♀, St Jean du Maroni (*Le Moult*) (BMNH). **Brazil**: 1 ♀, Rio Brilhante, Mato Grosso, 23–27.x.1970 (*Becker*) (coll. Becker, Brasilia).

REMARKS. This species is one of the few Neotropical taxa of Scardiinae that has an olivaceous 'moss' pattern resembling that of the *Morophaga choragella*-group. Other Neotropical taxa with this pattern are *Diataga* (with M_2 and M_3 stalked in the forewing and with very short outer tibial spurs) and *Morophagoides* (all veins free, pattern generally more variegated). In the forewing M_3 and CuA_1 are always stalked or connate; this characteristic is also found in the smaller and darker *Bythocrates* and in *Perilicmetis* with its characteristic dark brown subterminal fascia. The male genitalia are remarkable for their simplicity of structure, the female genitalia for the internal thickened and sclerotized ridge that is the posterior continuation of the apophyses anteriores extending and remaining conspicuous as far posteriorly as the setose apical region of the eighth sternite.

The females listed here may not be conspecific with each other or with the males. A single female from Arizona (see below) appears to be a congener but not conspecific. The female from Brazil has similar genitalia to those of the female from French Guiana but the ventral lip of the ostium is concave in the former and convex in the latter. The broad posterior region of the antrum is much less strongly sclerotized in the Brazilian specimen and the transverse constrictions of the ductus bursae are more numerous, about double the number present in the French Guiana specimen. The female from Costa Rica, with a 5 mm longer wingspan than the other specimens examined, has only 5 pairs of apical setae on the eighth sternite and a broader, shorter antrum lacking the narrow anterior region of the other two examples; the ductus bursae lacks transverse constrictions and the bursa copulatrix, although collapsed in preparation, does not extend beyond the apophyses anteriores.

Miniscardia species A

(Fig. 166)

ADULT. ♀, 17 mm. Coloration and external structure similar to *minimella*.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 166). Similar to those of *minimella* but ventral lip of ostium not extended as far posteriorly, and with distinct marginal bulbosity; antrum short, not extending anteriorly beyond inception of ductus seminalis; posterior region of ductus bursae distinctly scobinate on external surface; apex of eighth sternite with three pairs of strong setae.

DISTRIBUTION. U.S.A. (Arizona).

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.

U.S.A.: 1 ♀, Arizona, Cochise Co., Huachuca Mts, Miller Canyon, 7.viii.1974 (*Powell*) (genitalia slide; UC).

REMARKS. This specimen probably represents a species different from *minimella* but, with only a single female example in poor condition available for examination, its status remains uncertain. The matter is

complicated by the apparent variability of females of *minimella*. The example of *minimella* from Costa Rica has genitalia very similar to those of this specimen from Arizona; both lack sclerotization of the ductus bursae to form an antrum anterior to the inception of the ductus seminalis, and in both the ventral lip of the ostium is almost straight, rather than being convex as in examples from Brazil and French Guiana.

NECROSCARDIA gen. n.

Type-species: *Tinea funeratella* Zeller, 1863: 144.

Diagnosis. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus with fewer than 5 segments; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; pattern consisting of pale termen and dorsum on darker ground-colour. Male with coremata in eighth abdominal segment; coremata associated with elongate, rod-like apodemes at anterior corners of eighth sternite. Male genitalia with complex uncus separated from tegumen by narrow band of membrane; tegumen broken dorsally by at least a membranous suture line; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus wider than long; juxta complex, divided medially; vesica with spicular cornuti; aedeagus with spicular or spinose carinae.

Conspicuous autapomorphies. Apex of tegumen forming a single prong-like or bifid process dorsal to the uncus lobes; juxta enormously enlarged, bipartite, closely appressed to and forming a functional part of the valvae.

Distribution. Neotropical region – Venezuela, Colombia, Bolivia.

Biology. Unknown.

Key to species of *Necroscardia*

1 Pair of cream triangular marks on posterior margin of forewing equal in size (Fig. 54); male without large phylliform setae on eighth sternite; male with dorsal process from tegumen bifid, extending caudally well beyond lobes of uncus (Fig. 109); female seventh sternite with posterior margin strongly emarginated medially, with scattered field of strong, needle-like setae (Fig. 163) ..... ***morticina*** (p. 107)

– Proximal cream triangular mark on posterior margin of forewing considerably larger than distal mark which is reduced to a minute spot (Fig. 53); male with two pairs of enormous phylliform setae on posterior corners of eighth sternite (Fig. 110); male with dorsal process from tegumen a single spine, not extending beyond lobes of uncus (Fig. 108); female seventh sternite with posterior margin transverse, lacking needle-like setae ..... ***funeratella*** (p. 106)

Necroscardia funeratella (Zeller) comb. n.

(Figs 53, 108, 110, 164)

Tinea funeratella Zeller, 1863: 144. LECTOTYPE ♂, Venezuela, here designated [examined].

Adult (Zeller, 1863: pl. 2, fig. 6; Fig. 53). ♂, 20 mm; ♀, 23 mm. Vertex and frons brownish cream, reddish brown near eyes. Labial palpus cream flecked with brown, purple-brown on outer surface but pale at apex, sparsely scaled. Maxillary palpus greyish brown above, paler beneath, short, not as long as second segment of labial palpus, probably 3-segmented. Antennal scape and pedicel greyish brown; flagellum greyish brown cilia 1·7 × (♂) or 0·7 × (♀) flagellar diameter. Thorax and tegula cream, anterior third brown. Forewing purple-brown with cream terminal fascia containing brown speckling and small brown apical and medioterminal spots; costa with a few pale flecks; posterior margin with broad cream spot, large triangular cream spot almost at mid-point, and small cream spot at three-quarters. Hindwing light brownish grey. Legs cream, finely flecked with grey-brown; foreleg and mid-leg grey-brown above and on outer surfaces, tibiae traversed by cream band; articulations pale; outer mid-tibial spur 0·7 length of inner; outer proximal hind tibial spur 0·8 length of inner spur.

Genitalia ♂ (Figs 10B, 110). Eighth sternite with elongate apodemes reaching anterior margin of seventh sternite, at each posterior corner with one large and one small strong phylliform seta. Saccus broadly triangular, shorter than valvae; uncus lobes minute, setose, but sclerotized and lacking setae at apices,

surmounted by spike-shaped caudal process from vinculum almost as long as uncus lobes. Subscaphium not developed. Juxta strongly developed, bipartite, forming pair of tuberculate setose lobes surmounting and appressed basally to valvae; transtilla not developed. Valva short, plain, pyramidal, bearing lobe of juxta on inner surface. Aedeagus small, strongly tapered apically, and with scattered minute thorn-like carinae; vesica with very few minute spicular cornuti.

Genitalia ♀ (Fig. 164). Seventh sternite unmodified. Eighth tergite longer than eighth sternite, with line of minute setae at posterior margin, five or six pairs of very strong submarginal setae and four or five pairs of conspicuous but minute pits scattered in posterior one-quarter. Eighth sternite and genital tract pathologically deformed in specimen examined: illustrated but not described further here.

Distribution. Venezuela; Colombia.

Biology. Unknown.

Material examined. 2 ex.
Lectotype ♂, **Venezuela**: (genitalia slide no. 12379; BMNH).
Colombia: 1 ♀, Sierra del Libano, 6000′, v.1899 (*Smith*) (genitalia slide no. 12396; BMNH).

Remarks. For differentiation of *funeratella* and *morticina*, see the key above. The female described above resembles the lectotype remarkably closely and I am confident that they are conspecific. Walsingham identified the female as *funeratella* – the specimen bears his determination label.

Necroscardia morticina sp. n.

(Figs 54, 109, 162, 163)

Adult (Fig. 54). ♂, 21 mm. ♀, 17 mm. Coloration and external structure similar to *funeratella* but apices of second and third segments of labial palpus cream, third segment of ♂ entirely cream; cilia (♀) 3 × flagellar diameter; posterior margin of forewing with pale spots coalesced to form continuous band from base to tornus, spots triangular, of equal size; posterior and terminal cream fascia strongly speckled with purple-brown; outer mid-tibial spur 0·6 length of inner; outer proximal hind tibial spur 0·7 length of inner spur.

Genitalia ♂ (Fig. 109). Eighth sternite with short, rod-like apodemes reaching posterior margin of seventh sternite. Saccus broadly triangular, shorter than valvae; uncus lobes small, outer corners produced into shallow, setose process, inner posterior margin sclerotized and lacking setae, surmounted by V-shaped process from tegumen that extends well beyond tips of uncus lobes. Subscaphium not developed. Juxta strongly developed, bipartite, forming pair of strong, triangular setose lobes with shallowly serrate dorsocaudal margin appressed to and set in apices of valvae; transtilla not developed. Valva short, plain, half barrel-shaped, with juxta lobe set in top of 'barrel'. Aedeagus slender, apex sclerotized only on one side and duck's bill-shaped, with fine thorn-like carinae at apex; vesica with minute spicular cornuti near inception of ductus ejaculatorius.

Genitalia ♀ (Figs 162, 163). Seventh sternite rounded caudally, with shallow medial U-shaped emargination, strongly sclerotized, with scattered strong setae. Eighth tergite slightly longer than eighth sternite, with narrowly V-shaped mediocaudal emargination; posterior margin with numerous small setae, five pairs of strong submarginal setae; four or five pairs of scattered pits at four-fifths posteriorly; a few small, scattered setae at one-half. Eighth sternite wrinkled laterally, short, forming strong keel-shaped sterigma with trilobed apex (= ventral lip of ostium); apical one-third of sterigma with 10–12 pairs of strong, elongate setae. Antrum elongate, broad but tapering anteriorly, one-half length of apophyses anteriores, lined with elongate microtrichia; inception of ductus seminalis at posterior extremity of antrum (!). Ductus bursae as long as antrum, with fine transverse constrictions. Corpus bursae thin-walled, ovoid; signa absent.

Distribution. Bolivia.

Biology. Unknown.

Material examined. 2 ex.
Holotype ♂, **Bolivia**: Cochabamba, Yungas del Espiritu Santo, 1888–9 (*Germain*) (genitalia slide no. 12395; BMNH).
Paratype. 1 ♀, data as holotype (genitalia slide no. 12406; BMNH).

Remarks. For differentiation of *morticina* and *funeratella*, see the key above. The female paratype of

morticina is the only specimen of *Necroscardia* that could be considered to be in even fair conditions. Like the other three specimens, however, the second segment of the labial palpus is not densely scaled as in other scardiine genera with a similar wing-pattern (*Moscardia*, *Scardia*, *Daviscardia*).

TINISSA Walker

Tinissa Walker, 1864: 780; Robinson, 1976 (revision); 1981 (reclassification and additional species). Type-species: *Tinissa torvella* Walker, 1864: 780, by monotypy.

Polymnestra Meyrick, 1927: 331. Type-species: *Polymnestra perilithias* Meyrick, 1927: 331, by monotypy. [Synonymized by Gozmány & Vári, 1973: 85.]

Diagnosis. Antenna (male) lacking dorsal cilia, ventral surface scaled; cilia longer or shorter than flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) greater than 1·0. Maxillary palpus short, 3-segmented (but a few species with 5 segments) (Fig. 181); pilifers absent; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; pattern consisting of pale spots or speckles on darker ground-colour. Male with or without coremata in eighth abdominal segment; coremata without associated apodemes. Male genitalia with simple or complex uncus separated from tegumen by narrow band of membrane; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; tegumen broken dorsally by at least a membranous suture line; valvae separate, not fused together ventrally, without longitudinal cleft; saccus wider or narrower than long; juxta complex, entire in most species but narrowed ventrally almost to the point of division; vesica lacking spicular cornuti; aedeagus with or without spinose carinae.

Conspicuous autapomorphies. Hind tibia with apical and subapical tufts of elongate, dark-tipped scales; juxta of male complex, strongly modified and incorporated with valvae to form a functional valvae-juxta complex (as in *Necroscardia*); females of most species with segments VII markedly reduced in length but with extended intersegmental membrane between segments VII and VIII bearing a strong corethrogyne of fine, elongate scales.

Distribution. Afrotropical region; Oriental region; Australian region as far east as the Solomon Is and as far south as Queensland.

Biology. One species has been reared from fungus on bamboo (see Robinson, 1976: 257). Typical habitats are shown in Figs 199 and 200.

Remarks. Further treatment of *Tinissa* is not provided here: descriptions and illustrations of the 34 included species have been provided by Robinson (1976; 1981).

SCARDIELLA gen. n.

Type-species: *Scardia approximatella* Dietz, 1905: 27.

Diagnosis. Antenna (male) with dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with fewer than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. Male genitalia with complex uncus separated from tegumen by narrow band of membrane; tegumen broken dorsally by at least a membranous suture line; valva lacking basal setose lobe on inner surface; apex of valva not forming ventral hook or hooks, without spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica with spicular cornuti; aedeagus with spicular or spinose carinae.

Conspicuous autapomorphies. Bulbus ejaculatorius of male very large, almost 3 × length of aedeagus; ductus bursae of female with spicular inner surface from two-thirds to nine-tenths posteriorly (this also occurs, probably by convergence, in *Montescardia fuscofasciella*).

Distribution. Nearctic region.

Biology. Unknown.

Scardiella approximatella (Dietz) comb. n.

(Figs 52, 107, 161)

Scardia approximatella Dietz, 1905: 27. LECTOTYPE ♂, U.S.A. (NMNH), here designated [examined on author's behalf by D. R. Davis].

ADULT (Dietz, 1905: pl. 1, fig. 8; Fig. 52). ♂♀, 13–16 mm. Vertex and frons cream, tinted with brown around eyes. Labial palpus whitish, strongly flecked with brown on outer surface of second segment and middle of outer surface of third segment. Maxillary palpus whitish, flecked with light brown, 5-segmented, extending to three-quarters length of second segment of labial palpus. Antennal scape, pedicel and flagellum greyish buff, dark brown above, flagellum dark brown above only on basal five or six segments; cilia 2·0–2·5 × (♂) or 0·4 × (♀) flagellar diameter. Thorax and tegula cream, tegula strongly flecked anteriorly with brown, thorax flecked laterally and far anteriorly with brown. Forewing whitish, strongly flecked with light orange-brown, particularly along veins, and patterned with dark brown to form strong medial and basal fasciae and dense spotting over remainder of wing; fringe with medial grey-brown line and irregular chequering. Hindwing pale greyish cream, fringe lighter. Legs pale buff-cream, foreleg and mid-leg strongly marked with dark brown above and on sides (including tarsi) but pale at articulations and with strong whitish bar across mid-tibia; hind tarsus strongly marked above with brown; outer mid-tibial spur 0·6 length of inner; outer proximal hind tibial spur 0·7 length of inner spur.

GENITALIA ♂ (Fig. 107). Saccus elongate, triangular; uncus lobes a pair of digitiform processes, widely separated, strongly sclerotized. Subscaphium broad but represented only by slight thickening of diaphragma. Juxta represented only by almost imperceptible thickening of anellus; transtilla not developed. Valva short, rounded, with strong basicostal digitate process. Aedeagus stout, 7 × as long as broad, with shallowly triangular subapical carinae and numerous minute scattered thorn-like carinae; vesica with minute spicular cornuti (microtrichia); bulbus ejaculatorius very long, almost 3 × length of aedeagus.

GENITALIA ♀ (Fig. 161). Eighth tergite longer than eighth sternite, with three pairs of strong subapical setae; eighth sternite with strongly developed sterigma accommodating short, cylindrical antrum; eighth sternite quadrangular caudal to sterigma, hardly sclerotized, with two pairs of strong setae and 12–15 pairs of scattered smaller setae; ventral lip of ostium strongly concave. Antrum not extending beyond anterior margin of eighth sternite. Ductus bursae elongate, 1·5 × length of apophyses anteriores, lined with stout microtrichia anterior to inception of ductus seminalis at level of one-half length of apophyses anteriores (i.e., short length of ductus bursae posterior to ductus seminalis is without microtrichia). Corpus bursae pyriform, continuous with ductus, thin-walled; signa absent.

DISTRIBUTION. U.S.A.: Pennsylvania, New Jersey, District of Columbia, Maryland, Ohio (Dietz, 1905); New York; Massachusetts, Georgia (Forbes, 1923). Canada: Toronto.

BIOLOGY. The larva has been found in a rotten sycamore log (Forbes, 1923).

MATERIAL EXAMINED. 5 ex.

Lectotype ♂, **U.S.A.**: Maryland, Plummer's Island, vii.1901 (*Busck*) (NMNH) [examined on author's behalf by D. R. Davis].

U.S.A.: 1 ♀ (paralectotype), Pennsylvania, Hazleton, 15.vii.1896 (*Dietz*) (BMNH); 1 ♀, New York, Fishers, 21.vii.1933 (*Klots*) (genitalia slide no. 12403; BMNH). **Canada**: 3 ♂, Toronto, vi.1922 (*Parish*) (genitalia slide no. 12402; BMNH).

REMARKS. This small species is very distinctive. Its pattern is lighter than that of all other North American scardiines and resembles more that of a nemapogonine. The antennal cilia of the male are extraordinarily long: few other Scardiinae have cilia more than twice as long as the diameter of the flagellar segments. The strongly patterned hind tarsi are also characteristic: they are pale in most other scardiines. *Scardiella* appears to be a 'primitive' taxon. It has only six apomorphies (Table 1) and its affinities are obscure. Its apomorphic features are its elongate antennal cilia, absence of coremata, complex uncus, dorsally discontinuous tegumen, sparse setal patch on the second abdominal sternite, and its basicostal process on the valva. This last has been scored as a 'basal setose lobe' in Table 1, homologous with that of *Morophaga*, *Amorophaga* and *Diataga*. However, I believe it is an independent development and it is not included in the generic diagnosis. *Afroscardia* also has a setose lobe and this has been scored similarly; the lobe is subcostal and situated far distad on the valva. It seems unlikely that it is homologous with that of *Scardiella*. The affinity of the two taxa suggested by numerical analysis is, in all probability, due to convergence.

AFROSCARDIA gen. n.

Type-species: *Polymnestra capnochalca* Meyrick, 1932*b*: 207.

Diagnosis. Antenna (male) with dorsal cilia, ventral surface scaled; cilia longer than 1·5 × flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus with fewer than 5 segments; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 separate; M_2, M_3 and CuA_1 separate; mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. Male genitalia with simple uncus – a pair of setose lobes – fused with tegumen; tegumen broken dorsally by broad, membranous region; valva lacking basal setose lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta simple, entire, not divided medially; vesica lacking spicular cornuti; aedeagus with spicular or spinose carinae.

Conspicuous autapomorphies. Sclerotization of tegumen interrupted dorsally by broad membranous region between lateral arms of tegumen; lobes of uncus fused with tegumen so that genital armature terminates dorsocaudally in a pair of widely separated lobes.

Distribution. Afrotropical region – Uganda.

Biology. Unknown.

Afroscardia capnochalca (Meyrick) comb. n.

(Fig. 51)

Polymnestra capnochalca Meyrick, 1932*b*: 207. Holotype ♂, Uganda (BMNH) [examined].

Adult (Fig. 51). ♂♀, 18–20 mm. Vertex and frons purple-brown. Labial palpus purple-brown, second segment white on inner surface and on apex of ventral tuft. Maxillary palpus whitish, very short, 3-segmented. Antennal scape, pedicel and flagellum dark brown, paler beneath and on pecten; cilia 2·0 × (♂) or 0·8 × (♀) flagellar diameter. Thorax and tegula purple-brown. Forewing uniformly purple-brown with violet iridescence, apex slightly paler; fringe yellow. Hindwing greyish brown, fringe yellowish. Legs ochreous buff, dark brown above and on sides; outer mid-tibial spur 0·6 length of inner; outer proximal hind tibial spur 0·75 length of inner spur.

Genitalia ♂ (Gozmány & Vári, 1973: fig. 451). Saccus elongate, tapered, longer than tegumen + uncus; uncus lobes flap-like, small, widely separated, only weakly sclerotized; transtilla not developed. Valva elongately triangular with slightly hooked apex, with small subcostal setose lobe at two-thirds. Aedeagus slender, elongate, more than 15 × as long as broad, with very fine spicular subapical carinae; vesica without cornuti.

Genitalia ♀. Unknown.

Distribution. Uganda (Ruwenzori Mts).

Biology. Unknown.

Material examined. 5 ex.

Holotype ♂, **Uganda**: [Ruwenzori Mts], Bujubis, 12,000′, 16.viii.1931 (*Hancock*) (genitalia slide no. 10264; BMNH).

Uganda: 1 ♀ (paratype) (abdomen missing), Ruwenzori Mts, 10,000′, viii.1931 (*Hancock*) (BMNH); 1 ♂, Ruwenzori Range, Bigo, 11,400′, 29.vii.1952 (*Fletcher*) (BMNH); 2 ♂, Ruwenzori Range, heath zone above Nyamgasani Valley, 12–13,000′, xii.1934–i.1935 (*Buxton*) (BMNH).

Remarks. This is the only scardiine that has an entirely plain-coloured forewing. It resembles superficially *Bythocrates* from the New World, but in that genus the fringes are concolorous with the forewing and there is a row of pale spots along the costa. *Afroscardia* is distinctive also in that, despite its having a complete venation (although R_4 and R_5 are connate), it is very narrow-winged, the forewing more than four times as long as broad. The only other scardiine genus with the wings so slender is *Diataga*. The male genitalia of *Afroscardia* are distinctive in that the tegumen is broken dorsally by a membranous zone and the uncus lobes are widely separated: the terminal arms of the tegumen are strongly sclerotized and rod-like.

AMOROPHAGA Zagulajev

‡*Amorophaga* Zagulajev, 1966: 634. [Nomen nudum.]
Amorophaga Zagulajev, 1968: 329. Type-species: *Amorophaga hyrcanica* Zagulajev, 1968: 331, figs 1, 2, by original designation and monotypy.

DIAGNOSIS. Antenna (male) lacking dorsal cilia, ventral surface without scales; cilia longer than 1·5 × flagellar diameter (but shorter in *hyrcanica*). Scape with more than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with R_3 and R_4 stalked or very closely approximated at base; M_2, M_3 and CuA_1 separate; pattern elements consisting of greyish or olivaceous longitudinal streaks on a paler background. Male with coremata in eighth abdominal segment; coremata without associated apodemes. Male genitalia with complex uncus separated from tegumen by narrow band of membrane; tegumen broken dorsally by at least a membranous suture line; valva with setose basal lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae separate, not fused together ventrally, with deep emargination forming longitudinal cleft; saccus wider than long; juxta complex, divided medially; however, juxta simple and undivided in *cryptophori*; vesica lacking spicular cornuti; aedeagus with spinose carinae (but not in *cryptophori*).

CONSPICUOUS AUTAPOMORPHIES. Wing pattern composed of longitudinal streaks.

DISTRIBUTION. Holarctic – U.S.S.R. (Azerbaidjan), Nepal, Japan, U.S.A. (Idaho, California).

BIOLOGY. See *Amorophaga cryptophori* (Clarke).

Key to species of *Amorophaga*

Males (males of *rosemariae* are unknown)

1 Antennal cilia shorter than 1·5 × flagellar diameter; uncus broad, short, with pair of small lateral ventrally-directed hooks ..... ***hyrcanica*** (p. 113)
– Antennal cilia longer than 1·5 × flagellar diameter; uncus narrow, elongate, without lateral hooks 2
2 Uncus with pair of strong, curved processes directed ventrally and caudally and resembling a gnathos. (western U.S.A.) ..... ***cryptophori*** (p. 112)
– Uncus lacking any ventrally-directed processes (Fig. 112). (Japan) ..... ***japonica*** (p. 114)

Females (females of *hyrcanica* and *japonica* are unknown)

1 Forewing ground-colour cream (with olivaceous tint when fresh), strongly marked with orange-buff and dark brown, overall appearance olivaceous (Fig. 57); outer mid tibial spur only about 0·3 length of inner spur; frenulum with two bristles; seventh sternite with posterior margin strongly sclerotized and serrated (Fig. 168). (Nepal) ..... ***rosemariae*** (p. 111)
– Forewing ground-colour very pale grey, lightly marked with brownish grey, overall appearance greyish (Figs 58, 59); outer mid tibial spur one-half length of inner spur; frenulum with about six bristles; seventh sternite with smooth and only lightly sclerotized posterior margin. (western U.S.A.) ..... ***cryptophori*** (p. 112)

Amorophaga rosemariae sp. n.

(Figs 57, 167, 168, 198)

ADULT (Fig. 57). ♀, 23, 29 mm. Vertex and frons whitish, scales greyish brown basally. Labial palpus whitish, most scales of second segment tipped with blackish brown; third segment with elongate brown spot on outer surface. Maxillary palpus whitish, second and third segment with dark brown scales above. Antennal scape and pedicel pale buff, scape with a few dark dorsal scales; flagellum pale buff; cilia 1·0 × flagellar diameter. Thorax and tegula whitish, strongly flecked with brown. Forewing cream marked with orange-buff (particularly along veins) and dark brown; overall appearance olivaceous in fresh specimen but rapidly becoming brownish; pattern similar to that of *Morophaga choragella* but disrupted by longitudinal streaking; conspicuous dark spots at two-thirds of costa and in middle of posterior margin. Legs dull buff speckled with brown; foreleg and mid-leg strongly speckled with brown above, but all legs paler at articulations; outer mid-tibial spur 0·3 length of inner; outer proximal hind tibial spur 0·6 length of inner spur.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Figs 167, 168). Seventh sternite with strongly serrated and sclerotized posterior margin and with small V-shaped medial emargination. Eighth tergite narrow, shallowly bilobed posteriorly, with about 10 strong marginal setae and numerous smaller scattered marginal and submarginal setae; eighth sternite almost square in ventral view but extended laterally dorsad to almost meet the narrow tergite; ostium transverse, sternite transversely ridged to either side and extended caudally and inwardly to form pair of terminal lobes posterior to ostium, each bearing three strong setae and numerous smaller setae. Antrum smooth-walled to one-half length of sternite then strongly folded longitudinally anterior to inception of ductus seminalis, reaching two-thirds length of apophyses anteriores. Ductus bursae as long as antrum, very thin-walled, contiguous with corpus bursae which is elongately ovoid and thin-walled; signa absent.

DISTRIBUTION. Nepal.

BIOLOGY. Unknown. The holotype was collected at mercury-vapour light at about 2100 hrs in primary montane Himalayan oak forest (Fig. 198). The paratype was collected some 800 m lower down the same ridge, in the *Schima-Castanopsis* zone.

MATERIAL EXAMINED. 2 ex.

Holotype ♀, **Nepal**: Kathmandu district, Phulchoki, 2700 m (8800'), 28.v.1983 (*Robinson et al.*) (genitalia slide no. 6994; BMNH).

Paratype. **Nepal**: 1 ♀, data as holotype but 1950 m, mixed *Schima-Castanopsis* forest, 19.vi.1984 (*Allen*) (BMNH).

REMARKS. The generic placement of this species must be considered somewhat doubtful. *A. rosemariae* exhibits similarities to species of the *Morophaga choragella*-group (wing pattern; eighth sternite extended dorsally; antrum elongate and strongly folded) but differs sufficiently (in disruption of pattern and in laterocaudal extension of the eighth sternite) to make doubtful its attribution to that group. In placing it in *Amorophaga*, considerable weight is given to the wing-pattern. Such streaking of a recognizable pattern does not occur elsewhere in the Scardiinae and may represent a stage in the transformation of the *Morophaga*-type pattern to the markedly derived streaked pattern of the other three *Amorophaga* species. This is the only species of scardiine in which the caudal margin of the seventh sternite in the female is serrated.

The remaining three species of *Amorophaga* (*hyrcanica*, *cryptophori* and *japonica*) have a similar pale, streaked wing-pattern but that of *hyrcanica* is the palest and the most noticeably brown-tinted. The pattern of *cryptophori* is distinctly grey, that of *japonica* greyish brown (although both specimens of *japonica* are faded). The four species of *Amorophaga* are allopatric. A tentative phylogeny for the genus would have *hyrcanica* and *japonica* as sister-groups (synapomorphies: pale wing-pattern, ventrocaudal hook on valva, short, stout aedeagus), *cryptophori* the sister-group of *hyrcanica* + *japonica* (synapomorphy: wing-pattern) and *rosemariae* the sister-group of these three.

Amorophaga cryptophori (Clarke) comb. n.

(Fig. 58)

Morophaga cryptophori Clarke, 1940: 114. Holotype ♂, U.S.A. (NMNH) [not examined].

ADULT (Clarke, 1940: figs 2 [head], 3–3b [venation]; Fig. 58). ♂♀, 23–29 mm. Vertex and frons light greyish brown, all scales tipped with white. Labial and maxillary palpus coloured similarly. Antennal scape and pedicel light greyish brown, all scales tipped with white; pecten bristles darker brown, tipped with white; flagellum greyish brown, scales tipped with white; cilia 3 × (♂) or 1·0 × (♀) flagellar diameter. Thorax and tegula as head. Forewing very pale grey; strong speckles of brownish grey forming irregular longitudinal streaks, some darker marks at end of cell, and conspicuously barred termen and fringe. Hindwing pale grey. Legs brownish grey (but hind femur and tibia paler), paler beneath and at articulations above; fore- and mid-tibiae banded above with white at base and middle; outer mid-tibial spur 0·5 length of inner; outer proximal hind tibial spur 0·7 length of inner spur.

GENITALIA ♂ (Clarke, 1940: figs 1–1b, 5). Saccus very broad, 1·3 × as wide as long, and shorter than valvae or uncus; uncus lobes slender, digitiform, setose, anteriorly infolded ventrad to form pair of caudally-directed hooks resembling the two halves of a gnathos. Subscaphium slender, well-sclerotized, rod-like. Juxta elongately ovate, transversely wrinkled, rugose, moulded round anellus; transtilla not developed. Valva divided by longitudinal cleft into spatulate dorsal lobe and shorter, broader ventral lobe with irregularly dentate ventral margin and similarly dentate mediolongitudinal ridge converging with ventral margin close to base; base of valva with broad, setose ventral lobe. Aedeagus stout, 8 × as long as broad at

one-half, tapered and only sclerotized on dorsal surface from one-half, lacking carinae; vesica without cornuti.

GENITALIA ♀ (Clarke, 1940: figs 4, 4a). Eighth tergite with strongly trilobed posterior margin, with about 12 strong marginal setae and similar number of smaller setae; eighth sternite strongly sclerotized, ostium at a little beyond one-half, flanked by pair of short lobes, each with four or five strong setae and similar number of smaller setae; sternite produced into large, conspicuous caudal flap to side of each lobe. Antrum 1·5 × length of eighth sternite, transversely ridged close to ostium just anterior to inception of ductus seminalis at four-figths posteriorly; sides of antrum weakly folded ventrad in anterior third. Ductus bursae as long as antrum, very thin-walled. Corpus bursae almost spherical, very thin-walled; signa absent.

DISTRIBUTION. U.S.A. (Idaho, California).

BIOLOGY. The type-series was reared from *Cryptophorus* (= *Polyporus*) *volvatus* (Clarke, 1940). Lawrence & Powell (1969: 43) recorded *cryptophori* from the same fungus associated with *Abies* and *Pinus* in several scattered localities in California. They considered this to be the only Californian scardiine that is host-specific.

MATERIAL EXAMINED. 4 ex.

U.S.A.: 1 ♂, 3 ♀, California, El Dorado Co., Blodgett Forest, 13 m. E. of Georgetown, reared from *Polyporus volvatus* coll. 9.vii.1967, em. 23–26.vii.1967 (*Turner*) (BMNH).

REMARKS. The wing-pattern of this species is similar only to those of the Old World species *hyrcanica* and *japonica*. The male genitalia differ conspicuously in the structure of the uncus lobes which are extended ventrally and caudally to form a striking imitation of a gnathos (a structure absent in the Scardiinae).

Amorophaga hyrcanica Zagulajev

Amorophaga hyrcanica Zagulajev, 1968: 331, figs 1, 2. Holotype ♂, U.S.S.R. (ZI) [examined].

ADULT (Zagulajev, 1973: fig. 98). ♀, 21, 23 mm. (For full description, see Zagulajev (1968: 331, or 1973: 118).) Antennal cilia 1·0 × (♂) flagellar diameter. Forewing with R_3 and R_4 only approximated at base, cream patterned with diffuse longitudinal streaks of light purplish brown, conspicuous dark brown costal and terminal spots, strong basal streak and more diffuse subtornal blotch at three-quarters of posterior margin. Hindwing cream, darker marginal spots at ends of veins. Outer mid-tibial and outer proximal hind tibial spurs 0·5 length of inner spurs.

GENITALIA ♂ (Zagulajev, 1968: fig. 2; 1973: fig. 99). Saccus broad, as wide as or wider than long, as long as tegumen + uncus; uncus lobes almost fused in dorsal mid-line, inturned ventrad and strongly sclerotized laterally to form pair of blunt, ventrally-directed hooks. Valva with elongate, digitiform costal process extending well beyond uncus or ventral region of valva; ventral region bilobed, ventral lobe inturned, blunt, hook-like; base of valva with broad, setose membranous lobe; small, digitate process from middle of valva. Aedeagus about 6 × as long as broad at mid-length, as long as genital armature (excluding costal process of valva).

GENITALIA ♀. Unknown.

DISTRIBUTION. U.S.S.R. (Azerbaidjan).

BIOLOGY. Unknown.

MATERIAL EXAMINED. 2 ex.

Holotype ♂, **U.S.S.R.**: Azerbaidjan, Talysh, Astara dist., R. Lyakar, district of Mamagon Village (22 km W. of Pensar), 2000 m, 10.viii.1962 (*Zagulajev*) (ZI).

1 ♂ (paratype), data as holotype but Alashya Village, ix.1962 (ZI).

REMARKS. The antennal cilia of male *hyrcanica* are shorter than those of *cryptophori* or *japonica* (males of *rosemariae* are unknown) and the genitalia are distinctive; the other two species have the costal lobe of the valva flattened and smaller, and the uncus lobes are of different form (produced ventrally and caudally to form a passable copy of a gnathos – *cryptophori* – or tapered with subapical 'thorns' – *japonica*). See 'Remarks' for *A. rosemariae* for further comments.

Amorophaga japonica sp. n.

(Figs 59, 112)

ADULT (Fig. 59). ♂, 22 mm – holotype, 23 mm – paratype. (Both specimens faded.) Vertex and frons very light brown, scales strongly tipped with white. Labial palpus and maxillary palpus coloured similarly. Antennal scape and pedicel with scales light brown basally, otherwise whitish; flagellum whitish; cilia 2·5 × flagellar diameter. Thorax and tegula light brown, scales tipped with white. Forewing white, strongly speckled with light brown to form irregular longitudinal streaks and conspicuously barred termen and fringe. Hindwing light brownish grey. Legs light brown; foreleg and mid-leg darker above; all legs whitish at articulations; mid-tibia entirely whitish except for oblique brown streak on outer surface; outer mid-tibial spur and outer proximal hind tibial spur 0·7 length of inner spurs.

GENITALIA ♂ (Fig. 112). Saccus short, 1·5 × as broad as long; uncus lobes triangular, strongly sclerotized, setose, each with pair of small, subapical thorn-like projections. Subscaphium broad, tapered caudally. Juxta ill-defined, weakly sclerotized, ovate, moulded round anellus; transtilla not developed. Valva with short, setose costal lobe (probably homologous with dorsal lobe of *cryptophori* and costal process of *hyrcanica*) not reaching apex of valva; ventral (conspicuous) lobe of valva tapered and slightly hooked apically, with three small subapical thorn-like processes; ventral margin with strong dorsally-directed spine at two-thirds; base of valva with broad, setose, membranous lobe. Aedeagus stout, 7 × as long as broad, with elongate membranous channel extending dorsally from apex almost to base; apical quarter with fine, spicular carinae; vesica without cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. Japan.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 2 ex.
Holotype ♂, **Japan**: 1886 (*Pryer*) (genitalia slide no. 13354; BMNH).
Paratype. **Japan**: 1 ♂, Tottori, Daisen, 9–11.vii.1964 (*Takahama*) (coll. S. Moriuti, Osaka).

REMARKS. This species is superficially similar to *hyrcanica* and *cryptophori*. It has a finer and more greyish wing-pattern then *hyrcanica* but, from the limited material available, is not separable by external characteristics from *cryptophori*. The male genitalia differ in the extremely short costal process (dorsal lobe) of the valva being shorter than the ventral lobe of the valva: it is longer in the other two species. The uncus lobes are characteristic in all three species – modified to form a gnathos-like pair of processes in *cryptophori*, square-tipped and inturned to form a pair of small hooks in *hyrcanica* and elongately triangular with subapical 'thorns' in *japonica*.

DIATAGA Walsingham

Diatага Walsingham, 1914: 374. Type-species: *Diatага leptosceles* Walsingham, 1914: 375, pl. 10, fig. 26, by original designation and monotypy.

DIAGNOSIS. Antenna (male) lacking dorsal cilia, ventral surface without scales; cilia longer than 1·5 × flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs <0·4 length of inner spurs. Forewing with R_3 and R_4 stalked or very closely approximated at base; M_2 and M_3 stalked or very closely approximated at base; mottled coloration forming cryptic, coarse 'moss' pattern. Male with coremata in eighth abdominal segment; coremata associated with elongate, rod-like apodemes at anterior corners of eighth sternite. Male genitalia with simple uncus – a pair of setose lobes – separated from tegumen by narrow band of membrane; tegumen unbroken, completely sclerotized dorsally; valva with setose basal lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae separate, not fused together ventrally, without longitudinal cleft; saccus longer than wide; juxta complex, divided medially; vesica with spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

CONSPICUOUS AUTAPOMORPHIES. Two pairs of veins fused, stalked or connate in forewing; M_2 and M_3 stalked or very closely approximated at base in forewing; aedeagus bifurcated from close to base, dorsal arm with apex swollen; juxta bifid, forming pair of strongly defined lobes either side of anellus, and closely associated with basal setose lobes of valvae.

DISTRIBUTION. Neotropical region; Nearctic region – Arizona only.

BIOLOGY. See *Diataga leptosceles* Walsingham.

Key to species of *Diataga*

Males (males of *direpta* are unknown)

1 Uncus less than half as long as vinculum + tegumen, with pair of laterobasal spines (Fig. 120); saccus quadrangular, with concave anterior margin ..... ***mercennaria*** (p. 119)
– Uncus more than half as long as vinculum + tegumen, without spines; saccus triangular, with sharply convex anterior margin 2

2 Valva cleft to form hook-tipped ventral lobe (Fig. 115) ..... ***frustraminis*** (p. 116)
– Valva entire 3

3 Dorsal process of aedeagus markedly shorter than ventral arm (only two thirds-length of corresponding section of ventral arm) (Fig. 123) ..... ***brasiliensis*** (p. 117)
– Dorsal process of aedeagus almost as long as or longer than ventral arm (more than 0·85 length of corresponding section of ventral arm) 4

4 Apex of dorsal process of aedeagus bifid (Fig. 124) ..... ***compsacma*** (p. 118)
– Apex of dorsal process of aedeagus rounded 5

5 Valva with single elongate digitate process tipped with short fine spines (Fig. 118) ***levidensis*** (p. 118)
– Valva with three shallow thorn-like protuberances without spines (Figs 113, 114) ***leptosceles*** (p. 115)

Females (females of *compsacma*, *brasiliensis*, *frustraminis* and *levidensis* are unknown).

1 Eighth sternite explanate either side of and slightly anterior to ostium; dorsal margin of ostium with deep, U-shaped emargination (Fig. 170) ..... ***mercennaria*** (p. 119)
– Eighth sternite evenly tapered to ostium; dorsal margin of ostium either not emarginate or only shallowly concave 2

2 Membrane of ovipositor dorsal to ostium with strong transverse ridging; eighth tergite extending beyond level of ostium (Fig. 169) ..... ***leptosceles*** (p. 115)
– Membrane of ovipositor dorsal to ostium smooth; eighth tergite not reaching level of ostium (Fig. 171) ..... ***direpta*** (p. 120)

Diataga leptosceles Walsingham

(Figs 60, 113, 114, 121, 169, 183, 185–188, 193–197)

Diataga leptosceles Walsingham, 1914: 375. LECTOTYPE ♂, MEXICO (BMNH), here designated [examined].

ADULT (Walsingham, 1914: pl. 10, fig. 26 (colour); Figs 60, 183). ♂♀, 17–34 mm. Vertex and frons cream, streaked with brown close to eyes. Labial palpus cream flecked with light brown, whitish on inner surface, densely flecked with brown on upper surface of second segment. Maxillary palpus cream, densely flecked with brown above on second segment. Antennal scape and pedicel cream, densely flecked above with light brown; flagellum light buff; cilia 2·5 × (♂) flagellar diameter (females examined all have the antennae missing). Thorax whitish flecked with brown; tegula brown with a few white scales. Forewing densely mottled medium and dark brown, with a few scattered pale scales; termen with black spots edged with cream between veins; costa with rectangular cream spot at one-half, and one at three-quarters, smaller and inconspicuous white spots closer to apex. Hindwing dark grey. Legs cream, strongly flecked with brown above and at sides, more lightly below, but hind tarsus pale; outer mid-tibial and outer proximal hind tibial spur 0·25 length of inner spurs.

GENITALIA ♂ (Figs 113, 114, 121). Saccus slender, elongate, twice as long as broad; uncus lobes slender, elongate, 0·40 length of genital armature, moderately sclerotized, setose. Subscaphium elongate, ribbon-like. Juxta with collar-shaped base, forming pair of lateral shark's fin-shaped lobes with slightly ballooned membranous internal surface; transtilla collar-shaped, closely associated with setose and spinose lobes at bases of valvae. Valva with triangular process close to ventral margin, a further rounded or triangular process just dorsal to this, and a rounded or triangular process nearer to apex. Aedeagus with conspicuous mushroom-shaped dorsal arm extending well beyond ventral arm (aedeagus proper).

GENITALIA ♀ (Fig. 169). Eighth tergite narrow, elongate, with pair of subapical groups of setae, each consisting of 4–5 large and similar number of small setae; eighth sternite forming strongly developed sterigma, ostium apical and flanked either side by pair of large setae plus 4–5 small setae; membrane of

ovipositor dorsal to sterigma with strong transverse wrinkles. Antrum twice length of eighth sternite, inception of ductus seminalis at two-thirds posteriorly. Ductus bursae broadening gradually into pear-shaped corpus bursae that extends to 1·25 length of apophyses anteriores; signa absent.

DISTRIBUTION. (?)U.S.A. (Arizona – Lawrence & Powell, 1969); Mexico; Costa Rica; Ecuador; Trinidad; French Guiana; Brazil; Peru.

BIOLOGY. Lawrence & Powell (1969: 44) record this species from *Daedalea microsticta* in Mexico and (identified tentatively) from *Polyporus vulpinus* on *Populus fremontii* in Arizona. Becker (pers. comm.) has bred this species from a 'polyporus' in Costa Rica; larvae and pupae from this rearing are figured here (Figs 185–188, 193–197). For notes on larvae and pupae of this species, see 'Biology' for the Scardiinae, above.

MATERIAL EXAMINED. 14 ex.

Lectotype ♂, **Mexico**: Vera Cruz, Jalapa, 1895 (*Schaus*) (genitalia slide no. 12409; BMNH).

Mexico: 1 ♀, data as lectotype but 1897. **Ecuador**: 1 ♂, (*Joannis*). **Trinidad**: 1 ♂ (abdomen missing), vi.1905 (*Busck*). No data: 1 ♂. (All BMNH; all paralectotypes.) **Costa Rica**: 1 ♂, 1 ♀, Turrialba, 600 m, 6.iv.1975, 5.viii.1971 (*Becker*) (coll. V. O. Becker, Brasilia); 2 ♂, 3 pupae, 3 larvae, Turrialba, 25.v.1972 [bred from a fungus] (*Becker*) (coll. V. O. Becker, Brasilia). **French Guiana**: 1 ♂, Nouvelle Chantier, iv. (*Le Moult*) (BMNH). **Brazil**: 1 ♂, Amazonas, Prainha, at light, 17.xii.1873 (*Trail*) (BMNH); 1 ♂, Teffe, xii.1919 (*Parish*) (BMNH); 1 ♂, Sta Catarina, Brusque, 6.ix.1970 (*Becker*) (coll. V. O. Becker, Brasilia). **Peru**: 1 ♂, Pacaya, vi.1912 (*M.*) (BMNH).

REMARKS. One male paralectotype of *leptosceles* is not of this species but is referable to *frustraminis* (*q.v.*), the only other *Diataga* known that is dark-winged and almost patternless. *D. leptosceles* may be separated from *frustraminis* by its pale costal markings on the forewing (absent in *frustraminis*) and brown tegulae (whitish in *frustraminis*). The remaining species of *Diataga* are pale (*brasiliensis*, *compsacma*, *levidensis*, *mercennaria*) or have a strongly developed pattern (*direpta*) reminiscent of that of *Morophaga choragella*.

The male genitalia of specimens from French Guiana and Brazil differ slightly from those of the lectotype from Mexico in that the costa of the valva is emarginate close to the apex and the two dorsal processes of the valva are pointed rather than rounded. The significance, if any, of this regional variation may become clearer when further material is available. At present I consider the two genital types to represent a single species. The dorsal process of the aedeagus, and the form of the valva, differ from that exhibited by other *Diataga* species (compare illustrations). The male genitalia of *leptosceles* differ from *frustraminis* in lacking a ventrally hooked valva (compare illustrations) and in the form of the aedeagus; this has the dorsal process mushroom-shaped in *leptosceles* but spatulate and hooked in *frustraminis*. The apex of the aedeagus proper (the ventral arm of the aedeagus) is obliquely truncated in *leptosceles* and arum flower-shaped in *frustraminis*.

The female genitalia differ from those of the other two species of which the female is known (*mercennaria* and *direpta*) in that the dorsal margin of the ostium is shallowly concave (V-shaped in *mercennaria*; straight in *direpta*), the sides of the sterigma are not explanate as in *mercennaria*, the ostium is broader than in *direpta* and the eighth tergite extends caudally beyond the eighth sternite (it does not reach the tip of the sterigma in *direpta*).

Diataga frustraminis sp. n.

(Figs 61, 115, 122)

[*Diataga leptosceles* Walsingham, 1914: 375, partim – 1 ♂ only. Misidentification.]

ADULT (Fig. 61). ♂, 21 mm. Coloration and external structure similar to *leptosceles* but head and palpi not so heavily marked with brown, ground-colour chalky white rather than cream; thorax and tegula chalky white, only very slightly flecked with pale brown; legs paler and not as heavily marked with brown as in *leptosceles*; forewing costa with scattered pale scales but lacking pair of elongately rectangular cream spots present in *leptosceles*.

GENITALIA ♂ (Figs 115, 122). Saccus elongate and broad, 1·3 × as long as broad; uncus lobes elongate but only 0·25 length of genital armature, moderately sclerotized, setose. Subscaphium ribbon-like, broadened anteriorly. Juxta similar to that of *leptosceles*, apex of lobes distinctly membranous and ballooned; transtilla only weakly sclerotized, collar-shaped, inconspicuous, closely associated with spinose lobes at bases of valvae. Valva with strongly hooked ventral margin, separated from dorsal region bearing three triangular processes by deep emargination. Aedeagus with dorsal arm spatulate, strongly curved ventrad at

apex; ventral arm (the aedeagus proper) characteristically arum flower-shaped; base of vesica with small, sclerotized plate.

GENITALIA ♀. Unknown.

DISTRIBUTION. French Guiana; Brazil.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 3 ex.
Holotype ♂, **French Giuana**: Rio Maroni, St Laurent, xi.1906 (*Le Moult*) (genitalia slide no. 12411; BMNH) (paralectotype of *leptosceles*).
Paratypes. **Brazil**: 1 ♂, Teffe, xii.1919 (*Parish*) (genitalia slide no. 12415; BMNH); 1 ♂, Lower Amazon, W. end of Parana de Buyassu, 15.i.1896 (*Austen*) (genitalia slide no. 12414; BMNH).

REMARKS. For separation of this species from the superficially similar *leptosceles*, see above and under 'Remarks' for *leptosceles*.

Diataga brasiliensis (Zagulajev) **comb. n.**

(Figs 62, 116, 123)

Morophaga brasiliensis Zagulajev, 1966: 642. Holotype ♂, BRAZIL (MINGA) [examined].

ADULT (Fig. 62). ♂, 21 mm. Vertex and frons buff-cream. Labial palpus cream flecked with dark brown, third segment appearing very short as base surrounded by elongate scales of second segment. Maxillary palpus cream with dark brown spot above on second and third segments. Antennal scape and pedicel cream, flecked with brown above; flagellum cream; cilia 4 × flagellar diameter. Thorax and tegula cream flecked with brown. Forewing cream marked with orange-brown along veins and speckled with dark brown; however, speckling almost absent anterior to R_3, thus forming a paler costal fascia occupying anterior third of wing; dark quadrate costal spot at nearly two-thirds, smaller deep brown spots at apex of R_1 and at apex of wing between R_2 and R_3, and between R_4, R_5 and M_1. Hindwing brownish cream with distinct golden tint, darker towards margin, with grey apical and subapical (costal) spots. Legs all missing except for foreleg (on slide) and hind tibia (glued); hind tibia cream, flecked below with dark brown, apices of both proximal spurs and underside of larger (inner) spur dark brown; outer proximal hind tibial spur 0·35 length of inner spur.

GENITALIA ♂ (Zagulajev, 1966: fig. 5; Figs 116, 123). Saccus elongate, twice as long as broad; uncus lobes short but infolded ventrad and extended anteriorly, 0·25 length of genital armature, quite strongly sclerotized, setose only posteriorly, anteriorly wrinkled and more strongly sclerotized. Subscaphium short, broad, inverted T-shaped. Juxta with collar-shaped base, forming pair of triangular lateral lobes; transtilla collar-shaped, closely associated with triangular setose lobes at bases of valvae. Valva almost triangular, ventral margin inturned and with shallow medial and subterminal triangular processes; middle of valva with strong fold extending to apex where it terminates in a triangular process; swelling of apical process extended as a shallow ridge to process at middle of ventral margin. Aedeagus dorsal arm 0·65 length of ventral arm (aedeagus proper), tapered from two-thirds to apex; apex of aedeagus with shallow thorn-like carinae; base of aedeagus with strong caudally-directed lobe.

GENITALIA ♀. Unknown.

DISTRIBUTION. Brazil.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♂, **Brazil**: Rio Grande do Sul (genitalia slide [GSR]; MINGA).

REMARKS. In the original description of this species, Zagulajev (1966) gives a date of capture ('5.vii.') for the holotype. There is no date given on the data labels and the source of his information is unknown. The genitalia of the holotype were dissected and stored in glycerine in a vial by Zagulajev; I have mounted the genitalia in Euparal on a slide.

The external appearance of *brasiliensis* is distinctive; the hindwing is paler than that of *leptosceles*, *frustraminis* or *direpta*, more yellowish than that of *mercennaria*, and resembles that of *compsacma* or *levidensis* but is distinctively gold-tinted. The forewing pattern is paler than that of *leptosceles* or *frustraminis* and posteriorly as dark as *direpta* or *mercennaria*; however, the anterior third of the wing is pale. This division of the forewing into contrasting anterior and posterior fasciae is unknown in any other

scardiine. The genitalia of *brasiliensis* differ from those of all other *Diataga* in the form of the aedeagus, with its short dorsal arm, and the characteristic pattern of ridging and processes on the valva.

Diataga compsacma Meyrick

(Figs 63, 117, 124)

Diataga compsacma Meyrick, 1919: 270. Lectotype ♂, GUYANA (BMNH), designated by Clarke, 1970: 47 [examined].

ADULT (Clarke, 1970: pl. 23, fig. 1; Fig. 63). ♂, 15, 16 mm. Vertex and frons cream. Labial palpus cream, flecked with dark brown on outer and upper surfaces. Maxillary palpus cream flecked with brown above on second segment. Antennal scape and pedicel cream with a few brown scales; flagellum very pale buff; cilia 4 × flagellar diameter. Thorax and tegula cream flecked with brown. Forewing cream marked with orange-brown along veins and speckled with dark brown; dark speckling concentrated in ill-defined wedge-shaped costal spot at one-half, otherwise sparse; pair of apical dark brown spots between R_4 and R_5 and R_5 and M_1 edged inwardly by pair of cream transverse lines. Hindwing off-white, flecked apically with brown. Legs cream flecked with brown, foreleg and mid-leg more densely flecked, particularly above; outer mid-tibial spur 0·3 length of inner; outer proximal hind tibial spur about 0·35 length of inner spur (damaged).

GENITALIA ♂ (Clarke, 1970: pl. 23, figs 1a, 1b; Figs 117, 124). Saccus elongate, about twice as long as broad (but angled in preparation); uncus lobes elongate, broadened apically, 0·25 length of genital armature, moderately sclerotized, setose. Subscaphium strongly sclerotized, broadened into inverted Y-shape anteriorly. Juxta details not visible in preparation; transtilla, if present, very weakly sclerotized and occluded in preparation by slightly sclerotized and strongly setose lobes at bases of valvae. Valva with ventral margin turned inward and extended into a triangular spine at one-half; beyond this, a nodular, setose excrescence bearing a smaller dorsal spine; with wedge-shaped subapical process. Aedeagus with dorsal arm swollen distally, curved ventrad and bifurcate at apex, as long as ventral arm (aedeagus proper).

GENITALIA ♀. Unknown.

DISTRIBUTION. Guyana.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 2 ex.
Lectotype ♂, **Guyana**: Bartica, xii.1912 (*Parish*) (genitalia slide no. JFGC 6651; BMNH).
Guyana: 1 ♂ (paralectotype), data as lectotype but i.1913.

REMARKS. This species is of similar coloration to *levidensis* and *mercennaria* although the latter has a more strongly developed forewing pattern with elements similar to those of *direpta* weakly expressed. *D. compsacma* is smaller than *mercennaria* although this difference may not be significant when further material is discovered (see, for example, the size-range of *leptosceles*). The wing-pattern of *compsacma* is more brownish than that of *levidensis* and the brown markings on legs and mouthparts are heavier. The male genital armature of *compsacma* is, like that of *levidensis*, very small, only about 1·2 mm long. By contrast, the genital armature is more than 1·8 mm long in *mercennaria* and longer in the other species. The male genitalia of *mercennaria* are quite distinctive – see 'Remarks' for that species. The genital differences between *compsacma* and *levidensis* are in the valvae and aedeagus. In *compsacma* the valva bears a medial triangular process arising close to the ventral margin with, beyond it, a nodular setose excrescence; in *levidensis* the medial triangular process is very shallow and beyond it arises an elongate process with a chisel-shaped end. The dorsal arm (process) of the aedeagus is bifid in *compsacma* but only channelled longitudinally at the apex in *levidensis*.

Diataga levidensis **sp. n.**

(Figs 64, 118, 125)

ADULT (Fig. 64). ♂, 16 mm. Coloration similar to *compsacma*, but brown speckling of labial palpus and legs very light; second segment of maxillary palpus dark brown above; flagellum white; cilia 3 × flagellar diameter. Forewing flecked with whitish scales, these concentrated at costa to form broken pale costal streak from one-third. Hindwing off-white, flecked with brown apically and with dark brown apical spot. Outer mid-tibial spur 0·35 length of inner; outer proximal hind tibial spur 0·25 length of inner spur.

GENITALIA ♂ (Figs 118, 125). Saccus triangular, almost twice as long as broad; uncus lobes elongate,

broadened apically, 0·35 length of genital armature, moderately sclerotized, setose. Subscaphium strongly sclerotized, elongate, inverted T-shaped. Juxta with only weakly sclerotized collar-shaped base, forming pair of ovate lateral lobes; transtilla collar-shaped, closely associated with setose/spinose lobes at bases of valvae. Valva with shallowly inturned ventral margin forming shallow triangular process at one-third; from near middle of valva an elongate digitate process with chisel-shaped apex bearing four or five stiff bristles on internal bevel of 'chisel'. Aedeagus dorsal arm almost as long as ventral arm (aedeagus proper), explanate at apex, surface nearest ventral arm finely scobinate; base of aedeagus with small, round membranous areas appearing as perforations.

GENITALIA ♀. Unknown.

DISTRIBUTION. Peru.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♂, **Peru**: Iquitos, iii.1920 (*Parish*) (genitalia slide no. 12416; BMNH).

REMARKS. This small, pale species resembles superficially *compsacma* and is of similar size. The wing-pattern resembles also that of *mercennaria* (which is more variegated) but *mercennaria* is a larger species (about 20 mm wingspan as opposed to 16 mm in *levidensis*); however, this difference may not be significant when longer series of both species are available. The forewings of *compsacma* are more brownish and the mouthparts and legs more heavily flecked with brown than in *levidensis*. The male genitalia of *levidensis* are characterized by the valva bearing a single, elongate process with chisel-shaped apex and by the short dorsal arm of the aedeagus: only *brasiliensis* and *levidensis* have the dorsal arm shorter than the ventral arm (aedeagus proper). In *levidensis* the ventral swelling at the base of the aedeagus is particularly pronounced.

Diataga mercennaria sp. n.

(Figs 65, 119, 120, 126, 170)

ADULT (Fig. 65). ♂♀, 19–21 mm. Coloration of head and appendages, thorax and tegulae similar to *compsacma* but flagellum scales off-white tipped with brown in holotype (off-white in paratypes); cilia 3 × (♂) or 0·4 × (♀) flagellar diameter. Forewing cream, finely speckled with brown; speckles concentrated to form inwardly oblique dark fascia from two-thirds of costa; dark brown pair of apical spots between R_4 and R_5 and R_5 and M_1 edged inwardly with pair of fine white transverse lines. Hindwing light grey-brown with paler speckles towards apex; dark apical spot; some diffuse, smaller, dark terminal spots between veins. Legs cream speckled with dark brown, speckles concentrated at bases of tarsi, on upper surface of foreleg (solid brown on tibia) and to form pair of ill-defined diagonal streaks on outer surface of mid-tibia; outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·35 length of inner spur.

GENITALIA ♂ (Figs 119, 120, 126). Posterior margin of eighth sternite with short digitate process either side of mid-line. Saccus square, anterior margin concave, 1·5 × as long as broad; uncus lobes short, 0·25 length of genital armature, fairly strongly sclerotized, setose, with strong laterobasal spine. Subscaphium not developed. Juxta narrow and ill-defined medially, forming pair of contorted, strongly sclerotized lobes; transtilla strongly sclerotized, forming pair of flattened rods overlying and closely associated with setose/spinose lobes at bases of valvae. Valva with strongly folded ventral margin forming sclerotized lobe; small triangular process from folded surface at one-half. Aedeagus with dorsal arm slightly longer than ventral arm, apex slightly swollen and rounded; ventral arm (aedeagus proper) with membranous dorsal surface, apex with pair of shallow, sclerotized, dorsally-directed processes each bearing an internal wart; base of vesica (? or end of ductus ejaculatorius) with pair of sclerotized plates.

GENITALIA ♀ (Fig. 170). Eighth tergite elongate, with pair of subapical groups each comprising 3 large and 3 or 4 small setae; eighth sternite forming strongly developed sterigma with explanate sides; ostium apical, flanked either side by 6 or 7 strong setae and a few smaller setae, dorsal margin with V-shaped medial emargination. Antrum twice length of eighth sternite, dorsal wall folded into pair of shallow lobes at one-half at inception of ductus seminalis. Ductus bursae broadening gradually into corpus bursae that extends to 1·25 length of apophyses anteriores; ductus and corpus bursae strongly wrinkled (?unexpanded – virgin specimen); signa absent.

DISTRIBUTION. Trinidad; French Guiana.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 3 ex.
Holotype ♂, **French Guiana**: St Jean du Maroni, vii (*Le Moult*) (genitalia slide no. 12407; BMNH).
Paratypes. **French Guiana**: 1 ♂, Godebert-Maroni, v (*Le Moult*) (BMNH). **Trinidad**: 1 ♀, Caparo (*Birch*) (genitalia slide no. 12410; BMNH).

REMARKS. This is a large, pale species with some of the wing-pattern elements of the much darker *direpta*. While *mercennaria* is larger than known specimens of *compsacma* or *levidensis*, this size difference may not be significant when longer series are available for comparison. The male genitalia of *mercennaria* are quite distinct from those of other *Diataga*: the eighth sternite bears caudal processes, the saccus is truncated anteriorly with a slightly concave anterior margin, the uncus has a pair of laterobasal spines, the transtilla forms a pair of rods, the juxta lobes are contorted and the subscaphium is not developed. The female genitalia are distinctive in that the sterigma is laterally explanate, strongly setose to either side of the ostium, and the dorsal margin of the ostium is strongly emarginate.

Diataga direpta sp. n.

(Figs 66, 171)

ADULT (Fig. 66). ♀, 20, 23 mm. Coloration of head and appendages, thorax and tegulae similar to *compsacma* but head tufts with some brown scales admixed; flagellum scales off-white, some tipped with brown; cilia 0·3 × flagellar diameter. Forewing predominantly light brown, speckled with darker brown to form ill-defined oblique basal and postmedial fasciae; some whitish scales forming medial and subterminal blotches on costa, subterminal blotch broadly U-shaped. Hindwing light grey-brown with a few paler flecks at apex. Legs cream flecked with brown; foreleg more heavily flecked above, mid-tibia with pair of ill-defined oblique brown streaks on outer surface; outer mid-tibial spur 0·3 length of inner; outer proximal hind tibial spur 0·35 length of inner spur.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 171). Eighth tergite shorter than eighth sternite, with about 20 pairs of strong setae scattered along full length of tergite close to lateral margins; eighth sternite forming strongly developed sterigma bearing scattered setae of moderate size over posterior half; ostium apical, narrow, dorsal margin transverse, straight. Antrum twice length of eighth sternite, with slight longitudinal fold (?artefact), inception of ductus seminalis at two-thirds posteriorly. Ductus bursae broadening gradually into ovoid, thin-walled corpus bursae; signa absent.

DISTRIBUTION. Argentina.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 2 ex.
Holotype ♀, **Argentina**: Alta Gracia, ii.1934 (*C.B.*) (genitalia slide no. 12408; BMNH).
Paratype. 1 ♀, same data as holotype (BMNH).

REMARKS. This species resembles superficially *Morophaga choragella* (*q.v.*), so much so that Meyrick had identified the two specimens above as 'Scardia boleti' in his collection. While the wing-pattern of *direpta* is far more variegated than that of either *leptosceles* or *frustraminis*, it is nevertheless a large, dark species and more likely to be confused with one of these than with one of the smaller, paler species (*brasiliensis*, *compsacma*, *levidensis*, *mercennaria*). The female genitalia differ from those of *mercennaria* and *leptosceles* in that the sterigma is strongly setose in the posterior half, is not laterally explanate, and the ostial diameter is only about 0·06 mm (about 0·1 mm in *leptosceles*, 0·15 mm in *mercennaria*).

MOROPHAGA Herrich-Schäffer

Morophaga Herrich-Schäffer, 1853: (7), (22). Type-species: *Euplocamus morellus* Duponchel, 1838: 79, pl. 288, fig. 5, by subsequent monotypy (Herrich-Schäffer, 1854: 78).
Atabyria Snellen, 1884: 164. Type-species: *Atabyria bucephala* Snellen, 1884: 166, pl. 9, fig. 1, by monotypy. [Synonymized by Petersen (1959: 577).]
Osphretica Meyrick, 1910: 475. Type-species: *Osphretica chomatias* Meyrick, 1910: 475, by monotypy. [Synonymized by Gozmány (1966: 499).]
Microscardia Amsel, 1952: 139. Type-species: *Noctua boleti* F., 1777: 282, by original designation and monotypy. [Synonymized by Petersen (1959: 577).]

DIAGNOSIS. Antenna (male) lacking dorsal cilia, ventral surface without scales; cilia longer than 1·5 ×

flagellar diameter. Scape with more than 15 pecten bristles. Interocular index (male) 1·0 or less. Maxillary palpus 5-segmented; pilifers present; second segment of labial palpus shorter than width of head. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs, but less in *borneensis*. Forewing with R_3 and R_4 stalked or approximated at base; M_2, M_3 and CuA_1 separate; coloration usually mottled, forming cryptic, coarse 'moss' pattern, but conspicuously different – bold purple-brown markings on white – in *bucephala*-group. Male with or without coremata in eighth abdominal segment; coremata associated with elongate, rod-like apodemes at anterior corners of eighth sternite in *choragella*-group (but not in *fasciculata*). Male genitalia with simple uncus – a pair of setose lobes – separated from tegumen by narrow band of membrane; tegumen completely sclerotized dorsally or broken by a membranous suture line; valva with setose basal lobe on inner surface; apex of valva forming ventral hook or hooks, or with spines; valvae separate, not fused together ventrally, with deep emargination forming longitudinal cleft; cleft not present, however, in *bucephala*-group; saccus longer than wide; juxta simple (but complex in *clonodes*), entire, not divided medially; vesica with or without spicular cornuti; aedeagus with or without carinae.

Conspicuous autapomorphies. None; may be recognized, however, by combination of 'moss'-patterned forewing with R_3 and R_4 stalked (but note aberrant pattern of *bucephala*-group) and deeply cleft valva (not in *bucephala*-group).

Distribution. Western and eastern Palaearctic region; Afrotropical region; Oriental region; Australian region. Absent from the New World.

Biology. See under entries for individual species.

Remarks. Preliminary work on the Scardiinae in 1975 suggested that the type-species of *Scardia* was *Tinea mediella* Hübner, 1796, a result of the designation by Walsingham (November, 1914) of 'Noctua boleti F.' as type-species. *Noctua boleti* F., 1777, is not eligible for designation as type-species of *Scardia* Treitschke as it is not an included species. However, Walsingham included *Tinea mediella* Hübner, 1796, in his synonymy of *boleti* and, as *mediella* is one of the species included by Treitschke, its designation as type-species by Walsingham would have been valid (*Int. Code zool. Nom.*, Article 69(a) (v)) had it been the earliest designation. *Tinea mediella* Hübner, 1796, is currently considered to be a junior subjective synonym of *Tinea choragella* [Denis & Schiffermüller], 1775: 137 (Charpentier, 1821: 127).

This finding, which would have made *Scardia* the valid generic name for the species placed here in *Morophaga*, and *Fernaldia* the valid name for those in *Scardia*, was communicated to several workers *in litteris*. Generic combinations and synonymy based on the Walsingham designation were published by Davis (1983). My colleagues I. W. B. Nye and D. S. Fletcher have recently found an earlier designation of a type-species for *Scardia* by Busck (April, 1914). This designation (see below) maintains the usage of *Morophaga* and *Scardia* by authors with the exception of Davis (1983).

Morophaga could well be paraphyletic with respect to *Diataga* and *Amorophaga* – see the discussion following numerical analysis.

The *bucephala*-group

Diagnosis. Outer and mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing pattern conspicuous, bold purple-brown markings on a white ground-colour. Male with coremata in eighth abdominal segment; coremata without associated apodemes. Tegumen unbroken, completely sclerotized dorsally; valva without longitudinal cleft; juxta simple, entire, not divided medially; vesica lacking spicular cornuti; aedeagus with spicular or spinose carinae.

Conspicuous autapomorphies. Wing pattern of bold purple-brown blotches on a white or off-white background; valva with ventral margin extended caudally so that valva is rudder-shaped.

Distribution. Eastern Palaearctic region; Oriental region as far east as New Guinea; Afrotropical region. Absent from the western Palaearctic region and Australia.

Key to species of the *bucephala*-group

1 Distal margin of large spot on posterior margin of forewing angled towards apex of wing (Fig. 67); angle between extended ventral margin and dorsal region of valva with triangular process (Fig. 127); antrum less than one-half length of apophyses anteriores (Fig. 173) ***cremnarcha*** (p. 122)

– Distal margin of large spot on posterior margin of forewing angled towards middle of costa; angle between extended ventral margin and dorsal region of valva without triangular process; antrum at least four-fifths length of apophyses anteriores 2

2 Inner surface of labial palpus cream; maxillary palpus cream with a few darker scales on second and third segments; upper surface of hindleg ochreous, like under-surface; dorsal region of valva rounded apically (Fig. 128); antrum + ductus bursae as long as apophyses anteriores, corpus bursae only slightly offset to the left (Fig. 174) ..... ***bucephala*** (p. 123)

– Inner surface of labial palpus brown; maxillary palpus brown; upper surface of hindleg grey, paler at articuatlions; dorsal region of valva truncated apically; antrum + ductus bursae considerably longer than apophyses anteriores, ductus strongly looped to the left (Figs 175, 176) 3

3 Distal margin of large spot on posterior margin of forewing slightly concave or sinuate (Fig. 69); caudal extension of ventral region of valva rounded in cross-section, with subapical process (Fig. 129); microtrichia in antrum larger anteriorly than posteriorly ..... ***soror*** (p. 124)

– Distal margin of purple-brown spot on posterior margin of forewing strongly 'stepped' (Fig. 70); caudal extension of ventral region of valva flattened, truncated at apex, without subapical process (Fig. 130); microtrichia in antrum of uniform size ..... ***vadonella*** (p. 124)

Morophaga cremnarcha (Meyrick) **comb. n.**

(Figs 67, 127, 173)

Scardia cremnarcha Meyrick, 1932*b*: 323. LECTOTYPE ♂, KASHMIR (BMNH), here designated [examined].

Morophaga nigrocapitella Petersen, 1959: 571, pl. 32, fig. 1; fig. 19. Holotype ♂, AFGHANISTAN [SW.]: Arghandab R. (LN) [not examined]. **Syn. n.**

ADULT (Petersen, 1959: pl. 32, fig. 1; Fig. 67). ♂, 12–25 mm. ♀, 18–26 mm. Coloration and external structure similar to *bucephala* but ♂ antennal cilia 4 × flagellar diameter. Distal margin of large spot on posterior margin of forewing angled towards apex.

GENITALIA ♂ (Petersen, 1959: fig. 19; Zagulajev, 1973: fig. 62; Fig. 127). Similar to *bucephala* but valva with triangular process present in angle between caudal extension of ventral region of valva and dorsal region; bilobate process close to costa with distal lobe enlarged and tapered; aedeagus not as slender as in *bucephala*, only 15 × as long as broad, apical one-sixth with about six minute thorn-like carinae.

GENITALIA ♀ (Fig. 173). Similar to *bucephala*, but medial emargination of eighth sternite broader, V-shaped. Antrum short, half length of apophyses anteriores, not as thick-walled as in *bucephala*, inner surface evenly lined with fine microtrichia anteriorly from inception of ductus seminalis. Ductus bursae with four or five regular transverse constrictions, only slightly offset to the left. Corpus bursae with posterior diagonal ribbing.

DISTRIBUTION. Afghanistan; Kashmir; India (Uttar Pradesh, Himachal Pradesh, Bihar, Madras); Nepal.

BIOLOGY. Three of Meyrick's syntypes were found on 'old tree-stumps on which *Polyporus* was growing, but I could find no trace of larvae, pupae or cocoons in the fungus' (Fletcher – quoted by Meyrick, 1932*b*: 323). The specimen from the Shevaroy Hills referred to as '*Atabyria bucephala*' by Fletcher ([1921]: 189) was bred 'from cocoons about a fungus growth on a tree'. Fletcher (1933: 73), referring to this species as '*Scardia bucephala*', records adults (presumably the syntypes of *cremnarcha*) resting on rotten tree-stumps at Gulmarg, Kashmir.

MATERIAL EXAMINED. 12 ex.

Lectotype ♂, **Kashmir**: Gulmarg, 8800′, vii.1931 (*Fletcher*) (BMNH).

Kashmir: 1 ♂, 2 ♀ (paralectotypes), data as lectotype (BMNH). **India**: 1 ♀, Uttar Pradesh, Mukteswar, 19.vii.1927; 1 ♀, Himachal Pradesh, Dharmsala, 1879 (*Hocking*); 1 ♂, Himachal Pradesh, Kangra Valley, 4500′, ix.1899 (*Dudgeon*); 2 ♂, Bihar, Pusa, 12.viii.1909 & 30.vi.1919 (*H. L. D.*, *Fletcher*); 1 ♀ with pupa, Madras, Shevaroy Hills, Yercaud, from cocoons about a fungus growth on a tree, 21.iv.–4.v.1913 (*Y. R.*). **Nepal**: 1 ♀, Kathmandu District, Godaveri, 1700m, vii.1982 (*Allen*). (All in BMNH.)

REMARKS. The four species of the *bucephala*-group (*bucephala*, *soror*, *vadonella* and *cremnarcha*) are allopatric but restricted to the Old World; however, there may well be overlap of the ranges of *cremnarcha* and *bucephala* in NE. India and possibly Nepal. The wing patterns of three species are almost identical but that of *cremnarcha* is different, the large purple-brown spot on the posterior margin of the forewing being extended towards the wing-apex. The valva of *cremnarcha* bears a characteristic triangular flap between the dorsal lobe and the caudal extension, and the aedeagus is somewhat stouter (length = 15 × width, as opposed to 20–25 × in the other species); in the female the antrum is only half the length of the apophyses

anteriores as opposed to roughly the same length in the other species. The wing-patterns of *bucephala*, *soror* and *vadonella* are similar, but the distal margin of the large spot on the posterior margin of the forewing is 'stepped' in *vadonella* (more so in the two females examined than in the rather worn male holotype) and in examples of *bucephala* from New Guinea; *bucephala* from elsewhere, and *soror*, have the margin slightly concave or sinuate. Both *vadonella* and *soror* differ from *bucephala* in having the whole of the labial palpus and the maxillary palpus brown – in *bucephala* the inner surface of the labial palpus is cream, as is the maxillary palpus except for some darker scaling on the second and third segments. In *bucephala* the dorsal region of the valva is rounded distally but it is truncated in *soror* and *vadonella*: microtrichia are restricted to the anterior one-quarter of the antrum in *bucephala* but evenly scattered in the other two species. The major difference between *soror* and *vadonella* lies in the form of the valva: the caudal extension of the ventral margin is rounded in cross-section in *soror* and bears a short subapical process. This process is absent in *vadonella* and the caudal extension of the valva is flattened and truncated. Differences in the female genitalia are minimal – the eighth sternite of *soror* is marginally narrower than that of *vadonella* and the microtrichia in the antrum are larger anteriorly whereas in *vadonella* they are of uniform size. The bursa copulatrix is not as elongate in *vadonella* as in *soror* (but still longer than in *bucephala*).

A tentative phylogenetic sequence for the group would have *soror* and *vadonella* as sister-groups (synapomorphies: colour of palpi, truncation of dorsal region of valva, strongly looped and elongate ductus bursae), *bucephala* as their sister-group (synapomorphies: forewing pattern, very slender aedeagus), and *cremnarcha* as the sister-group of the other three.

Morophaga bucephala (Snellen)

(Figs 68, 128, 174)

Atabyria bucephala Snellen, 1884: 166, pl. 9, fig. 1. LECTOTYPE ♂, U.S.S.R. (ZI), here designated [examined].

Osphretica chomatias Meyrick, 1910: 475. Holotype ♂, SARAWAK (BMNH) [examined]. [Synonymized by Bradley, 1965: 116.]

Depressaria rotundata Matsumura, 1931: 1091. Lectotype ♀, JAPAN (EIHU), designated by Ridout, 1981: 36 [not examined]. [Synonymized by Bradley, 1965: 116.]

ADULT (Snellen, 1884: pl. 9, fig. 1a (colour); Issiki, 1957: fig. 49 (colour); Zagulajev, 1973: pl. 2, fig. 5 (colour); Fig. 68). ♂♀, 11–23 mm. Vertex and frons purple-brown, paler towards mouth. Labial palpus brown on outer surface, cream on inner surface. Maxillary palpus cream, some darker scaling on second and third segments. Antennal scape and pedicel dark brown; flagellum ochreous, some darker scales dorsally; cilia 3 × (♂) or 0·3 × (♀) flagellar diameter. Thorax and tegula purple-brown anteriorly, cream posteriorly. Forewing cream with a brownish tint, patterned with bold purple-brown spots; distal margin of large posterior spot weakly concave or sinuate (but strongly stepped in examples from New Guinea and in one of two specimens known from Assam). Hindwing grey. Legs ochreous cream; foreleg and mid-leg dark brown above but pale at articulations; outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·5 length of inner.

GENITALIA ♂ (Petersen, 1959: fig. 20; Zagulajev, 1973: fig. 59; Fig. 128). Saccus elongate, as long as tegumen + uncus; uncus lobes short, infolded ventrad, hardly sclerotized, setose. Subscaphium elongate, ribbon-like. Juxta weakly developed, shield-shaped; transtilla inverted U-shaped, closely associated with setose lobes at bases of valvae. Valva with rounded ventral apex, with m-shaped bilobate process close to costa. Aedeagus slender, 25 × as long as wide, apical fifth with about 15 minute, thorn-like carinae; vesica without cornuti.

GENITALIA ♀ (Petersen, 1959: fig. 21; Zagulajev, 1973: figs 60, 61; Fig. 174). Eighth tergite slightly longer than eighth sternite, with subapical row of about 8 strong setae and apical line of numerous smaller setae; eighth sternite only weakly sclerotized, m-shaped, posterior margin forming ventral lip of ostium. Antrum tapered anteriorly, then slightly swollen posterior to inception of ductus seminalis at level of anterior margin of eighth sternite; anterior to inception of ductus seminalis only weakly sclerotized, but thick-walled, almost reaching apices of apophyses anteriores; with fine microtrichia on inner surface of anterior one-quarter (and also medially in a specimen from New Guinea). Ductus bursae very short, weakly turned to the left. Corpus bursae thin-walled, ovoid; signa absent.

DISTRIBUTION. U.S.S.R. (Amur, Chabarovsk, Primorsk – Zagulajev, 1973); China (Kwangtung – Meyrick, 1934; Kiangsu – Meyrick, 1935; Yunnan – Meyrick, 1938); Japan; Korea; India (Assam); Burma; Malaya; Borneo; Sulawesi; New Guinea.

BIOLOGY. See Zagulajev (1973: 81) for an account of the habitat and dates of appearance of this species which does not appear to have been reared.

MATERIAL EXAMINED. 69 ex.

Lectotype ♂ (of *Atabyria bucephala*), **U.S.S.R.**: Primorsk, Chabarovsk, Suifun, 14.viii.1887 (ZI). Holotype ♂ (of *Osphretica chomatias*), **Sarawak**: Kuching, x.1907 (*Hewitt*) (BMNH).

67 ex., various localities (see 'Distribution') (BMNH, ZI).

REMARKS. See 'Remarks' for *cremnarcha*, above. The distribution of *bucephala* is surprisingly broad. However, only females are known from New Guinea and their conspecificity with material from the eastern U.S.S.R. is uncertain.

Morophaga soror Gozmány

(Figs 69, 129, 176)

Morophaga soror Gozmány, 1965: 281, fig. 33. Holotype ♂, CONGO (HNHM) [not examined].

ADULT (Fig. 69). ♂♀, 14–23 mm. Coloration and external structure similar to *bucephala* but labial palpus brown on inner surface; maxillary palpus brown; antennal cilia (♂) 2·0–2·5 × flagellar diameter; upper surface of hindlegs greyish, paler at articulations. Forewing with distal margin of large posterior spot usually slightly concave.

GENITALIA ♂ (Gozmány, 1965: fig. 33; Gozmány & Vári, 1973: fig. 449; Fig. 129). Similar to *bucephala* but valva with dorsal region markedly truncated; caudal extension of ventral region thus proportionately longer, with blunt dorsally-directed subapical process; aedeagus slender, about 20 × as long as broad, apical one-quarter with about 8 minute thorn-like carinae (carinae more numerous – about 30 – in a specimen from Uganda, Ruwenzori).

GENITALIA ♀ (Gozmány & Vári, 1973: fig. 450; Fig. 176). Similar to *bucephala* but strong setae mixed with smaller setae at posterior margin of eighth tergite. Antrum with inner surface evenly lined with microtrichia anteriorly from inception of ductus seminalis (but posterior microtrichia only one-third length of those in anterior region of antrum). Ductus bursae elongate, with regular transverse constrictions, and strongly looped to the left.

DISTRIBUTION. Sierra Leone; Ivory Coast; Ghana; Cameroon; Fernando Poo (Equatorial Guinea); Uganda; Kenya. Reliable literature records also exist for Congo, Zaire and Zambia (Gozmány & Vári, 1973: 148).

BIOLOGY. Unknown.

MATERIAL EXAMINED. 33 ex., various localities (see 'Distribution') (BMNH).

REMARKS. See 'Remarks' for *bucephala*, above.

Morophaga vadonella (Viette)

(Figs 70, 130, 175)

Sporadartha [sic] *vadonella* Viette, 1954: 78, fig. 4. Holotype ♂, MADAGASCAR (MNHN) [examined].
Morophaga vadonella (Viette) Gozmány, 1969: 295.

ADULT (Fig. 70). ♂, 15 mm. ♀, 17, 19 mm. Coloration and external structure similar to *bucephala* but labial palpus brown on inner surface; maxillary palpus brown; ♂ antennal cilia 2·5 × flagellar diameter; upper surface of hindleg greyish, paler at articulations. Distal margin of large spot on posterior margin of forewing 'stepped' or strongly concave.

GENITALIA ♂ (Viette, 1954: fig. 4; Fig. 130). Similar to *bucephala* but dorsal region of valva markedly truncated apically; caudal extension of ventral region thus proportionately longer, square-ended, without blunt subapical process; aedeagus slender, about 25 × as long as broad, with only one ill-defined and minute subapical thorn-like carina.

GENITALIA ♀ (Gozmány, 1969: fig. 11; Fig. 175). Similar to *bucephala* but differing in the same details as *soror*; eighth sternite slightly broader than in *soror*, bursa copulatrix not as elongate, microtrichia of antrum of even size.

DISTRIBUTION. Madagascar.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 3 ex.

Holotype ♂, **Madagascar** [NE.]: Maroantsetra, x.1952 (*Vadon*) (MNHN).

Madagascar: 1 ♀, Betroka, 1955 (*Diehl*); 1 ♀, Ambinanindrano, 50 km W. of Mohanoro, i.1913 (*Kestell-Cornish*) (BMNH).

REMARKS. See 'Remarks' for *bucephala*, above.

The *morellus*-group

DIAGNOSIS. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with mottled coloration forming cryptic, coarse 'moss' pattern. Male with coremata in eighth abdominal segment; coremata not associated with apodemes. Tegumen unbroken, completely sclerotized dorsally; valva with deep emargination forming longitudinal cleft; juxta simple, entire, not divided medially; vesica lacking spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

CONSPICUOUS AUTAPOMORPHIES. See species' description.

DISTRIBUTION. Western Palaearctic region.

Morophaga morellus (Duponchel)

(Fig. 71)

Euplocamus morellus Duponchel, 1838: 79, pl. 288, fig. 5. Syntypes, 1 ♂, 1 ♀, [FRANCE] (?MNHN) [not examined].

Morophaga morella f. *fungicolella* Dumont, 1930: 286. Syntypes, 1 ♂, 3 ♀, TUNISIA (BMNH) [examined]. **Syn. n.**

ADULT (Duponchel, 1838: pl. 288, fig. 5 (colour); Zagulajev, 1973: pl. 1, fig. 1 (colour); Fig. 71). ♂♀, 21–28 mm. Vertex and frons greyish brown, scales tipped with white, pair of paler lateral tufts arising close to tentorial pits. Labial palpus greyish brown, scales tipped with white, but inner surface buff; third segment diffusedly banded with black basally and subapically. Maxillary palpus cream, dark scales above on second and third segments. Antennal scape and pedicel ochre-brown, with darker brown ventral scales; flagellum medium brown; cilia 2·5 × (♂) or 0·4 × (♀) flagellar diameter. Thorax and tegula dark brown anteriorly, light grey-brown posteriorly. Forewing ground-colour light brown, strongly speckled and mottled with dark brown, dark spots concentrated medially and subterminally. Hind wing light grey-brown with some ill-defined darker speckles towards apex. Legs buff but foreleg and mid-leg dark brown above, banded with buff at articulations; hind tibia light greyish above; outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·5 length of inner.

GENITALIA ♂ (Petersen, 1957: fig. 244; Zagulajev, 1968: fig. 7, 1973: fig. 48). Saccus broadly triangular but as long as tegumen + uncus; uncus lobes short, square-ended, infolded both mesad and ventrad, moderately sclerotized, setose. Subscaphium ill-defined, broadening posteriorly. Juxta large, shield-shaped and conspicuously wrinkled; transtilla not developed. Valva with emargination separating ventral lobe bearing three peg-like processes from smaller dorsal lobe bearing subapical ventral flap. Aedeagus stout, S-shaped, 5 × as long as wide, without carinae; vesica lacking cornuti.

GENITALIA ♀ (Petersen, 1957: fig. 245; Zagulajev, 1968: fig. 8, 1973: figs 49, 50). Eighth tergite as long as eighth sternite, with subapical row of about eight strong setae; eighth sternite strongly sclerotized, medially emarginate anteriorly, extended posteriorly into pair of digitate processes each bearing three strong setae and overlying ostium. Antrum cylindrical, 0·25 length of apophyses anteriores. Ductus bursae short, 0·5 length of antrum. Corpus bursae globular, only reaching two-thirds length of apophyses anteriores; signa absent.

DISTRIBUTION. S. France; Morocco; Tunisia; Sardinia; Sicily; Malta. Also reliably recorded in the literature from Spain, Algeria (Dumont, 1930); Asia Minor (Petersen, 1957); Italy, Greece (Rhodes) (Petersen & Gaedike, 1979); U.S.S.R. (Crimea, Caucasus) (Zagulajev, 1973).

BIOLOGY. This species has been bred from an excrescence on *Morus* (Duponchel, 1838), bred from *Xanthochisma plorans* on *Populus* and from fungus in hollow *Pistacia atlantica* (Dumont, 1930), bred from a polypore on *Quercus suber* (Martelli & Arru, [1959]) and bred from dead wood of *Quercus* (Staudinger, 1880: 270). The biology of this species has been discussed by Dumont (1930) who described the egg, larva and pupa.

MATERIAL EXAMINED. 25 ex.

Syntypes (of *Morophaga morella* f. *fungicolella* Dumont), 1 ♂, 3 ♀, **Tunisia**: Maknassy, bred from fungus in *Pistacia*, various dates 1929–30 (*Dumont*) (BMNH).

21 ex., various localities (see 'Distribution') (BMNH, ZI).

REMARKS. The only scardiine with a circum-Mediterranean distribution, *morellus* may be recognized by its wing-pattern which is brownish, rather than olivaceous as in members of the *choragella*-group. The characteristic short, square-ended uncus lobes of the male serve to differentiate it from all other *Morophaga* species. Its habitat is probably rather different from that of most other Scardiinae; whereas most species inhabit moist forest and woodland, the distributional records of *morellus* suggest that it is an inhabitant of much drier environments with open sclerophyll forest.

The *sistrata*-group

DIAGNOSIS. Outer mid and proximal hind tibial spurs <0·4 length of inner spurs. Forewing with mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. However, coremata present (not associated with apodemes) in *borneensis*. Tegumen broken dorsally by at least a membranous suture line; valva with deep emargination forming longitudinal cleft; juxta simple, entire, not divided medially; vesica with spicular cornuti; aedeagus smooth-surfaced, without spicular carinae.

CONSPICUOUS AUTAPOMORPHIES. Uncus lobes fused apically and forming a small hook; aedeagus and vesica elongate, vesica with line of strong cornuti (but not in *borneensis*).

DISTRIBUTION. Oriental region.

Key to species of the *Morophaga sistrata*-group (females are known only of *sistrata*)

Males

1 Coremata present in eighth abdominal segment; aedeagus short, less than 1·0 mm long, lacking cornuti (Fig. 135) ..... ***borneensis*** (p. 126)
– Coremata absent from eighth abdominal segment; aedeagus elongate, more than 1·25 mm long, with many stout cornuti (Figs 136, 137) 2
2 Saccus elongate, 2·0–2·2 × as long as wide; apex of dorsal half of valva in the shape of a horse's head; ventral margin of ventral half of valva smooth (Fig. 132) ..... ***sistrata*** (p. 127)
– Saccus exceptionally elongate, 2·5 × or more as long as wide; apex of dorsal half of valva evenly rounded; ventral margin of ventral half of valva with strong pectinifer 3
3 Pectinifer on ventral margin of valva regular; strong hook-shaped process between pectinifer and base of valva (Fig. 133) ..... ***formosana*** (p. 128)
– Pectinifer on ventral margin of valva irregular; no process between pectinifer and base of valva (Fig. 134) ..... ***iriomotensis*** (p. 128)

Morophaga borneensis sp. n.

(Figs 72, 131, 135)

ADULT (Fig. 72). ♂, 13 mm. Vertex and frons cream, darker scales near eyes. Labial palpus cream flecked with brown, pale on inner surface, at apex of second segment and on outer surface of third segment except for brownish basal and subapical spots. Maxillary palpus cream, dark brown above on second and third segments. Antennal scape cream; pedicel dark brown; flagellum ochreous, darker brown above on basal three segments; cilia 2·0–2·5 × (♂) flagellar diameter. Thorax and tegula brown, a little paler posteriorly. Forewing (very worn) cream, marked with orange-brown on veins and strongly mottled with dark brown. Hindwing light brownish grey. Legs ochreous cream; foreleg and mid-leg dark brown above but pale at articulations and in middle of tibiae. (Hindlegs missing.) Outer mid-tibial spur 0·3 length of inner spur.

GENITALIA ♂ (Figs 131, 135). Small coremata present in eighth segment, without associated apodemes. Saccus only as long as tegumen + uncus; uncus lobes extending just beyond apices of valvae, fused caudally and slightly hooked at apex. Subscaphium strongly developed, broad, ribbon-like. Juxta shield-shaped, only weakly sclerotized; transtilla inverted U-shaped, closely associated with small, digitate setose lobes at bases of valvae. Valva cleft (emarginate) for half its length, dorsal lobe with inwardly-directed triangular flap at apex; ventral lobe with hooked apex, pair of small, triangular sclerotizations extending dorsad from ventral margin across membranous inner face. Aedeagus short and stout, 6 × as long as broad at mid-length, without carinae; vesica without cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. Borneo.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ♂.

Holotype ♂, **Sabah**: Ulu Dusun, 30 miles W. of Sandakan, lowland dipterocarp forest, 28–31.i.1976 (*Classey*) (genitalia slide no. 13197; BMNH).

REMARKS. This species is the smallest member of the *sistrata*-group. It may be separated from the three others also by the characteristic form of the valva, the presence of coremata, and the short, stubby aedeagus which lacks cornuti.

The *sistrata*-group is Oriental and the distributions of its four constituent species are allopatric. The female of only *sistrata* is known, so the diagnostic comments here are confined to males. Externally, all four species are remarkably similar although *borneensis* is very small (13 mm as opposed to 16–20 mm in the other species) and is matched in size only by a single dwarf (12 mm) example of *sistrata*. Rather smaller and darker than members of the *choragella*-group, members of the *sistrata*-group cannot be reliably separated externally. Males of two species possess pectinifers on the ventrodistal margin of the valva: the pectinifer is neat and regular in *formosana* but proximally irregular in *iriomotensis*. Of the other two species, *borneensis* possesses a pair of small coremata in the eighth segment but *sistrata* does not. Other differences are highlighted below. A phylogenetic arrangement of the species would have *formosana* and *iriomotensis* as sister-groups (synapomorphy: valval pectinifer), *sistrata* as the sister-group of this pair (synapomorphy: loss of coremata) and *borneensis* as the sister-group of the other three.

Morophaga sistrata (Meyrick) **comb. n.**

(Figs 73, 132, 136, 179)

Scardia sistrata Meyrick, 1916: 618. LECTOTYPE ♂, SRI LANKA (Ceylon) (BMNH), here designated [examined].

ADULT (Fig. 73). ♂♀, (12 mm dwarf), normally 16–20 mm. Vertex and frons light brown, scales tipped with cream. Labial palpus cream flecked with brown, third segment with basal and subapical brown rings. Maxillary palpus whitish, flecked with brown on upper surface. Antennal scape cream, marked with brown above, pecten bristles light brown tipped with cream; pedicel brown; flagellum creamy brown; cilia 3 × (♂) or 0·5 × (♀) flagellar diameter. Thorax and tegula cream, densely flecked with brown anteriorly. Forewing cream, marked with orange-brown along veins and densely mottled with dark brown. Hindwing light brownish grey, some darker and lighter speckling at apex. Legs ochreous cream flecked with brown; foreleg and mid-leg brown above but pale at articulations, mid-tibia with pale band at one-half, hind tarsus brown basally; outer mid-tibial and outer proximal hind tibial spurs 0·3 length of inner spurs.

GENITALIA ♂ (Figs 132, 136). Coremata absent. Saccus elongate, longer than tegumen + uncus; uncus lobes extending well beyond apices of valvae, fused caudally, forming slight apical hook, weakly sclerotized, setose. Subscaphium well-defined, ribbon-like. Juxta moderately sclerotized, U-shaped; transtilla inverted U-shaped, closely associated with small, digitate setose lobes at bases of valvae. Valva deeply cleft (emarginate), dorsal lobe with horse's head-shaped apex; ventral lobe with hooked apex and triangular basal lobe. Aedeagus slender, elongate, 12 × as long as wide at mid-length, lacking carinae; vesica with broken line of about 80 small, strong cornuti.

GENITALIA ♀ (Fig. 179). Eighth tergite longer than eighth sternite, with 7 or 8 strong marginal setae towards apex and similar number of smaller setae; eighth sternite almost triangular, irregularly margined, with medial ostium flanked by pair of stout digitate processes, each with 3 strong apical setae and numerous smaller setae. Antrum twice length of eighth sternite, not extending beyond inception of ductus seminalis. Ductus bursae relatively thick-walled, contiguous with corpus bursae, with ventral scobinate band (not microtrichia). Corpus bursae thin-walled, extending to almost twice length of apophyses anteriores; signa absent (but pathological sclerotization of wall of ductus bursae present in one example examined).

DISTRIBUTION. Sri Lanka; India; Thailand; Malaya; Sulawesi; Philippines.

BIOLOGY. Larvae have been found feeding in decayed *Polyporus* (Meyrick, 1916: 618) in Ceylon and have been reared at Dehra Dun, India, from a fungus (Fletcher, 1933). The biology of this species, found in *Fomes* sp. at Pusa, Bihar, India, is described in detail by Fletcher ([1921]: 186).

MATERIAL EXAMINED. 51 ex.

Lectotype ♂, **Sri Lanka** (Ceylon): Puttalam, x.1904 (*Pole*) (BMNH).

Sri Lanka (Ceylon): 1 ♂, 1 ♀, Puttalam, v., x.1904 (*Pole*); 3 ♀, Wellawaya, xi.1905 (*Alston*); 1 ♀, Peradeniya, vii.1905 (*Green*); 1 ♂, 1 ♀, 1904 (*Pole*) (paralectotypes; all BMNH); 18 ex., Colombo, Puttalam, Peradeniya, Nawalapitiya (BMNH). **India**: 2 ♂, 1 ♀, Bihar, Pusa, 20.vii.1907, 2.ix.1908, 6.xi.1908 (*Fletcher*) (paralectotypes; BMNH); 12 ex., Lucknow ('ex 1. in fungus'), Pusa, Karwar, N. Arcot – Sangarambadi ('from a fungus') (BMNH). **Thailand**: 2 ♂, without detailed locality (BMNH). **Malaya**: 1 ♂, Prov. Wellesley, 'a fungus on coconut stump', 22.vi.1920 (*Corbett*) (BMNH). **Sulawesi** (Celebes): 1 ♀, Sangihe I. ('Sanguir'), 1892 (*Doherty*) (BMNH); 2 ♂, Sulawesi Utara, Dumoga-Bone National Park, alluvial forest, ii.1985 (*Barlow*; *Holloway*) (BMNH). **Philippines**: 1 ♂, 1 ♀, Palawan, Brookes Point, Uring Uring, 22.viii., 27.ix.1961 (*Noona Dan Exp.*) (ZM); 1 ♂, Mindanao, Sapamoro, Curuan dist., 16.xii.1961 (*Noona Dan Exp.*) (ZM).

REMARKS. There are minor racial differences between the male genitalia of *sistrata* from Sri Lanka and examples from the Philippines. The horse's head-shaped dorsal apex of the divided valva is broader and slightly more inturned in Philippine specimens. The triangular flap-like process on the ventral margin of the valva is basal in Sri Lankan examples but somewhat larger and situated further distad, almost at one-half the length of the ventral margin of the valva, in specimens from the Philippines.

Joannis (1930: 742) has recorded this species from Vietnam (Hanoi): the record is unconfirmed but is not unlikely.

Morophaga formosana sp. n.

(Figs 74, 133, 137)

ADULT (Fig. 74). ♂, 18 mm; ♀, 16 mm. Vertex and frons cream, tufts close to tentorial pits basally dark. Labial palpus cream flecked with brown, brown scales concentrated at base and middle of third segment. Maxillary palpus cream flecked with brown, dark brown scales above on second segment. Antennal scape cream (worn); pedicel dark brown; flagellum light ochre; cilia 3 × (♂) or 0·5 × (♀) flagellar diameter. Thorax and tegula whitish, brown anteriorly. Forewing whitish (?faded) marked with orange-brown on veins and strongly mottled with dark brown. Hindwing light brownish grey. Legs cream flecked with brown. Foreleg and mid-leg strongly marked with blackish brown above but pale at articulations and in middle of tibia; outer mid-tibial and outer proximal hind tibial spurs 0·3 length of inner spurs.

GENITALIA ♂ (Figs 133, 137). Coremata absent. Saccus elongate, 1·2 × length of tegumen + uncus; uncus lobes slender, extending a little beyond apices of valvae, fused caudally, forming shallow and inconspicuous ventral hook, moderately sclerotized, setose. Subscaphium well-defined, ribbon-like. Juxta narrowly U-shaped, well-sclerotized; transtilla strongly developed, inverted U-shaped, closely associated with small, digitate setose lobes at bases of valvae. Valva cleft (emarginate) for one-third its length, costa with thorn-like process at three-quarters; ventral lobe with larger thorn-like process from ventral margin at one-half and with well-ordered apical pectinifer of about 14 spines. Aedeagus elongate, slender, 18 × as long as wide at mid-length, lacking carinae; vesica with broken line of about 80 small, strong cornuti.

GENITALIA ♀. Unknown.

DISTRIBUTION. China; Taiwan.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 3 ex.

Holotype ♂, **Taiwan**: Taihoku, vi.1935 (*Issiki*) (genitalia slide no. 13119; BMNH).

Paratype. **Taiwan**: 1 ♀, Tainan, 10.iv.1906 (*Wileman*) (abdomen missing) (BMNH).

Excluded from paratype series. **China**: 1 ♂, Fu-chou ('Foochow'), 1935–6 (*Yang*) (BMNH).

REMARKS. Males of this species differ from both *sistrata* and *borneensis* in possessing a conspicuous pectinifer at the apex of the ventral lobe of the valva; a pectinifer is also present in *iriomotensis* (see 'Remarks' for that species). Like *sistrata* (but unlike *borneensis*) the aedeagus is elongate, the vesica bears a row of about 80 small, strong cornuti and the eighth segment lacks coremata.

Morophaga iriomotensis sp. n.

(Fig. 134)

ADULT. ♂, 19 mm. Similarly patterned to *sistrata* and *formosana* (see above).

GENITALIA ♂ (Fig. 134). Coremata absent. Saccus narrow, 2·5 × as long as wide, elongate, 1·3 × length of tegumen + uncus; uncus lobes slender, extending a little beyond apices of valvae, fused caudally, forming shallow and inconspicuous ventral hook, moderately sclerotized, setose. Subscaphium weakly sclerotized, ribbon-like. Juxta weakly sclerotized, heart-shaped, contiguous with M-shaped posteriorly-directed extension of medioventral margin of vinculum; transtilla inverted U-shaped, closely associated with small, digitate setose lobes at bases of valvae. Valva short, deeply cleft (emarginate); costa with shallow, lobe-like subapical process and broad, thorn-shaped process at one-half; ventral lobe with strongly dentate ventral margin, dentations regular and digitate at apex, forming a pectinifer with about 10 spines, but irregular and shallow in basal two-thirds. Aedeagus elongate, about 20 × as long as broad at mid-length, lacking carinae; vesica with line of 70–80 small, strong cornuti from base to apex.

GENITALIA ♀. Unknown.

DISTRIBUTION. Ryukyu Is.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ♂.

Holotype ♂, **Ryukyu Is.**: Iriomote, Maire-gawa, 8.ix.1965 (*Arita*) (genitalia slide no. 1060 [Robinson]; coll. S. Moriuti, Osaka).

REMARKS. Externally practically identical with *sistrata* and *formosana*, this species has, like *formosana*, a more slender saccus than *sistrata* (in which the saccus is only about twice as long as wide); unlike *formosana*, the medioventral margin of the vinculum has an M-shaped process protruding between the valvae and contiguous with the weak juxta. The valva of *iriomotensis* resembles that of *formosana* in having a pectinifer (unlike *sistrata*), but the more proximal processes of the ventral margin of the valva are less ordered and there is no strong spine from the mid-point of the margin as in *formosana*. The costa of the valva has a stronger thorn-like process situated further proximad than that of *formosana*.

The *clonodes*-group

DIAGNOSIS. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with mottled coloration forming cryptic, coarse 'moss' pattern. Male lacking coremata in eighth abdominal segment. Tegumen unbroken, completely sclerotized dorsally; valva with deep emargination forming longitudinal cleft; juxta complex, entire, not divided medially; vesica with spicular cornuti; aedeagus with spicular or spinose carinae.

CONSPICUOUS AUTAPOMORPHIES. See species' description.

DISTRIBUTION. Australian region.

Morophaga clonodes (Meyrick) **comb. n.**

(Figs 75, 138, 172)

Scardia clonodes Meyrick, 1893: 523. Holotype ♂, AUSTRALIA (BMNH) [examined].
Scardia porphyrea Lower, 1903: 74. Holotype ♀, AUSTRALIA (SAM) [examined]. **Syn. n.**
Scardia maculosa Diakonoff, 1949: 317. Holotype ♀, BURU (RNH) [examined]. **Syn. n.**

ADULT (Fig. 75). ♂♀, 18–26 mm (♀ from Emirau I., 15 mm). Vertex and frons cream mixed with brown. Labial palpus cream flecked with brown, brown spot on outer surface of third segment. Maxillary palpus whitish, flecked with brown above on second and third segments. Antennal scape whitish, base brown dorsally, pecten bristles cream; pedicel ochreous, dark brown dorsally; flagellum dull buff, some darker dorsal scales towards base; cilia 1·5–2·0 × (♂) or 0·4 × (♀) flagellar diameter. Thorax and tegula ochreous cream, strongly speckled with brown anteriorly. Forewing cream marked with orange-brown on veins and strongly mottled with dark brown. Hindwing ochreous grey with violet iridescence, some paler apical mottling. Legs ochreous cream, strongly flecked with dark brown; foreleg and mid-leg dark brown above but pale at articulations and across middle of mid-tibia; scaling on upper surface of hind tibia not flecked, distinctively ochreous; outer mid-tibial spur 0·4 length of inner spur; outer proximal hind tibial spur 0·5 length of inner spur.

GENITALIA ♂ (Fig. 138). Coremata absent. Saccus very broad, 1·25 × as long as wide, elongate, 1·3 × length of tegumen + uncus; uncus lobes small, infolded ventrad, moderately sclerotized, setose. Subscaphium not developed. Juxta a small plate lying dorsal to large m-shaped ventrocaudal extension of vinculum which broadly separates valvae; transtilla not developed. Valva highly modified, complex, with

pair of strongly sclerotized, blade-shaped ventral lobes, strong mediocostal spine and elongate, setose basicostal lobe extending almost twice length of remainder of valva; setose lobes at bases of valvae probably represented by extensive setose basidorsal area between basicostal lobe and anellus. Aedeagus slender, 15 × as long as broad at mid-length, with minute subapical thorn-like carinae; vesica with fine spicular cornuti.

Genitalia ♀ (Fig. 172). Intersegmental membrane between seventh and eighth segments with pair of lateroventral pockets, each with conspicuously scobinate lining. Eighth tergite quadrate, shorter than eighth sternite, with row of about 8 strong subterminal setae and 4 smaller terminal setae; eighth sternite very short laterally, produced mediocaudally to form a sterigma terminating in a pair of lobes, each with three strong terminal setae and numerous smaller setae; ostium at one-half length of sterigma. Antrum almost one-half length of apophyses anteriores, strongly sclerotized and longitudinally ridged; inception of ductus seminalis just posterior to anterior margin of eighth sternite. Ductus bursae and corpus bursae contiguous, pear-shaped, extremely thin-walled, not reaching apices of apophyses anteriores; signa absent.

Distribution. (?)Moluccas (Buru); Australia; New Guinea (Emirau I., Dyaul I.); Norfolk I.

Biology. Specimens in the BMNH collection have been bred from fungus on the roots of *Acacia aulacocarpa* and from dead wood of *Prunus persica*.

Material examined. 72 ex.

Holotype ♂ (of *Scardia clonodes*), **Australia**: New South Wales, South Creek, 2.iii.1878 (*Meyrick*) (BMNH). Holotype ♀ (of *Scardia porphyrea*) (more than 20 fragments in gelatine capsule), **Australia**: Queensland, Cooktown (SAM). Holotype ♀ (of *Scardia maculosa*) (head and thorax on pin; about 15 fragments in two gelatine capsules), **Moluccas**: Buru, Station 1, 1922 (*Toxopeus*) (RNH).

Australia: 51 ex., Queensland, Townsville, ex fungus on roots of *Acacia aulacocarpa*, various emergence dates, iii, iv.1901 (*Dodd*) (BMNH); 16 ex., Queensland, Townsville, Toowong, Dawson R., Rockhampton, Herberton, Peak Downs, Huberton Hills, Kuranda, various dates (*Dodd, Barnard*), including 1 ♂ from Toowong, ex 'dead wood of Peach tree' (BMNH). **New Guinea**: 1 ♀, St Matthias Group, Emirau ('Squally') I., viii.1923 (*Eichhorn*) (BMNH); 1 ♂, Dyaul I., Sumuna, 7.iii.1962 (*Noona Dan Exp.*) (ZM). **Norfolk I.**: 1 ♀, in house J.E./Red Road, 170 m, 18.x.1977 (*Jowett & Jowett*) (BMNH).

Remarks. While the general appearance of *clonodes* is typical of that of other *Morophaga* (with the exception of members of the *bucephala*-group), well-preserved specimens are distinctive in that the hindwing has violet iridescence and the erect scales on the upper surface of the hind tibia are bright ochreous. The genitalia of both sexes are distinctive. In the female, the scobinate intersegmental pockets are a conspicuous autapomorphy; however, shallow and smooth-surfaced pouches (no more than accentuated infolding of the membrane) are found also in the *choragella*-group. The highly modified male genitalia are peculiar within the genus in that coremata are absent (as in three of the four species of the *sistrata*-group) and the subscaphium and transtilla are not developed. The form of the valva is also highly characteristic.

Scardia maculosa Diakonoff was described from a single specimen without abdomen. In the original description the specimen is said to be a male. Upon receipt of the holotype, it was found that the specimen, mounted on elder pith (and already, apparently, stuck together with glue), had broken loose in transit and was very badly damaged. The fragments revealed, however, the typical venation of a *Morophaga* with R_3 and R_4 stalked at one-half, wing-pattern (rubbed) typical of the *sistrata*-group or *clonodes*, the outer mid-tibial spur 0·4 the length of the inner spur and the outer proximal hind tibial spur 0·5 the length of the inner spur. The antennae are those of a female, with a cilia length of about 0·6 the flagellar diameter. The comparative length of the tibial spurs probably precludes this species from the *sistrata*-group. Diakonoff's reference to the iridescence of the hindwing is suggestive of affinity to *clonodes*. Accordingly, *maculosa* is tentatively synonymized with *clonodes* although this requires a dramatic extension of the geographical range of the latter species.

The *choragella*-group

Diagnosis. Outer mid and proximal hind tibial spurs >0·4 length of inner spurs. Forewing with mottled coloration forming cryptic, coarse 'moss' pattern. Male with coremata in eighth abdominal segment; coremata associated with elongate, rod-like apodemes at anterior corners of eighth sternite but apodemes lacking in *fasciculata*. Tegumen broken dorsally by at least a membranous suture line; valva with deep emargination forming longitudinal cleft; juxta simple, entire, not divided medially; vesica with spicular cornuti; aedeagus with spicular or spinose carinae.

CONSPICUOUS AUTAPOMORPHIES. Only group within *Morophaga* with rod-like apodemes from anterior corners of eighth segment (but see *Diataga* and *Necroscardia*); however, apodemes absent in *fasciculata*; valva with large, hook-shaped articulated process (absent in *fasciculata* but the large apical depression in the valva suggests that the ancestor of this species may have had this process).

DISTRIBUTION. Western and eastern Palaearctic region.

Keys to species of the *Morophaga choragella*-group

Males (males of *kobella* are unknown)

1 Valva lacking sickle-shaped articulated process; ventral margin of valva with dense bundle of rod-like setae (Fig. 139). (Japan) ..... ***fasciculata*** (p. 133)
– Valva with large sickle-shaped articulated process; ventral apex of valva lacking rod-like setae ... 2

2 Ventral apex of valva forming a single strong hook. (Caucasus) ..... ***hyrcanella*** (p. 132)
– Ventral apex of valva rounded, with marginal line of small, shallowly dentate processes. (western Palaearctic region, east to Novosibirsk) ..... ***choragella*** (p. 131)

Females

1 Antrum elongate, extending anteriorly beyond apices of apophyses anteriores (Fig. 177) ***kobella*** (p. 133)
– Antrum short, not reaching one-half length of apophyses anteriores 2

2 Eighth tergite separating dorsolateral extensions of eighth sternite; ventral margin of ostium transverse (Fig. 178). (Japan) ..... ***fasciculata*** (p. 133)
– Eighth tergite posterior to dorsolateral extensions of eighth sternite which almost meet dorsally; ventral margin of ostium V-shaped, deeply emarginate. (Western Palaearctic region; Caucasus, Siberia) 3

3 Lateral sclerotization of eighth sternite extending dorsally and caudally beyond lobes that form lateral margins of ostium. (Caucasus) ..... ***hyrcanella*** (p. 132)
– Lateral sclerotization of eighth sternite not extending beyond lobes that form lateral margins of ostium. (Western Palaearctic region east to Novosibirsk) ..... ***choragella*** (p. 131)

Morophaga choragella ([Denis & Schiffermüller])

(Figs 76, 189–192)

Tinea choragella [Denis & Schiffermüller], 1775: 137. [AUSTRIA.] No type-material extant.
Noctua boleti F., 1777: 282. [EUROPE.] No type-material extant. [Synonymized by Charpentier, 1821: 127.]
Tinea fungella Thunberg, 1794: 93. [SWEDEN.] No type-material extant. [Synonymized by Karsholt & Nielsen, 1976: 21.]
Tinea mediella Hübner, 1796: 19, pl. 3, fig. 19. [EUROPE.] No type-material extant. [Synonymized by Charpentier, 1821: 127.]

ADULT (Curtis, 1836: pl. 591 (colour); Duponchel, 1838: pl. 288, fig. 3 (colour); Spuler, 1910: pl. 91, fig. 31 (colour); Wood, 1839: pl. 49, no. 1565 (colour); Zagulajev, 1973: fig. 51; Fig. 76). ♂♀, 21–30 mm. Vertex and frons cream. Labial palpus cream mixed with brown, apical segment with ill-defined subapical and basal brown rings. Maxillary palpus cream mixed with light brown, dark brown scales above on third segment. Antennal scape cream, basally mixed with brown on dorsal surface; pedicel dark brown above; flagellum ochreous, scales tipped with grey; cilia 3 × (♂) or 0·7 × (♀) flagellar diameter. Thorax and tegula cream, dark brown anteriorly. Forewing cream marked with orange-brown (particularly along veins), medium brown and dark brown (overall appearance distinctly olivaceous, particularly in fresh specimens). Hindwing grey, paler flecks at apex; bases of fringe scales paler. Legs cream; foreleg and mid-leg strongly marked with dark brown above in basal half of each segment; hindleg similarly marked with light grey; outer mid-tibial spur 0·5 length of inner; outer proximal hind tibial spur 0·7 length of inner.

GENITALIA ♂ (Petersen, 1957: fig. 240; Zagulajev, 1968: fig. 9, 1973: fig. 52). Coremata present in eighth abdominal segment, associated with elongate, rod-like apodemes from eighth sternite. Saccus 0·6 length of tegumen + uncus; uncus lobes elongate, digitiform, moderately sclerotized, setose. Subscaphium ill-defined, ribbon-like. Juxta plate-shaped, contiguous with vinculum; transtilla inverted elongate U-shaped, closely associated with setose lobes at bases of valvae. Valva divided by deep emargination into dorsal and ventral lobes; ventral lobe rounded, ventral margin with row of shallowly dentate processes; dorsal lobe

with deep recess accommodating mobile and strongly sclerotized hook-shaped process. Aedeagus curved, 9 × as long as broad, apex tapered gently, with fine spicular carinae; vesica with fine spicular cornuti.

GENITALIA ♀ (Petersen, 1957: fig. 241; Zagulajev, 1968: fig. 10, 1973: fig. 53). Eighth tergite displaced caudally, shield-shaped, with slight posteromedial emargination; caudal margin with about 10 strong setae. Eighth sternite broad, lateral margins extended dorsally to almost meet anterior to the displaced tergite; ventrally a broad plate, extended caudally into pair of broad lobes with narrow emargination between them, overlying ostium. Antrum funnel-shaped and smooth-walled to inception of ductus seminalis at 0·6 ventral length of eighth sternite anteriorly, then cylindrical with longitudinal ribbing, extending 0·4 length of apophyses anteriores. Ductus bursae short, 0·4 length of antrum. Corpus bursae very thin-walled, ovoid, extending slightly beyond apices of apophyses anteriores; signa absent.

DISTRIBUTION. Probably all European countries north of the Mediterranean, including Scandinavia and Finland; Bulgaria and Rumania; U.S.S.R. east to Novosibirsk Province (Zagulajev, 1973); Asia Minor. The identity of the specimen recorded from China (Yunnan) by Meyrick (1938) has not been confirmed.

BIOLOGY. Described by a number of European authors – see Zagulajev (1973) for a bibliography. The larva has been described in detail by Hinton (1956: 258, figs 1–14). This is a widespread and common species that has been bred from many species of bracket-fungi and from dead wood permeated by fungal hyphae.

MATERIAL EXAMINED. 346 ex., larvae and pupae, from various localities (see 'Distribution') (BMNH, ZI).

REMARKS. Males of *choragella* and *hyrcanella* may be recognized by the conspicuous articulated hook set in the dorsal lobe of the valva; however, this hook is absent in *fasciculata* although the depression in the valva that accommodates the hook in the other species is present. The male of *kobella* is unknown. *M. choragella* is smaller than *hyrcanella* (which is restricted to the Caucasus) and the ventral lobe of the valva (formed into a hook in *hyrcanella*) has a marginal row of shallowly dentate processes. Females are characterized by the short antrum and dorsally extended eighth sternite of which the ventral caudally-directed lobes are the posteriormost part.

Records of this species from Japan (e.g. Inoue, 1954: 17) are erroneous and may refer instead to either *kobella* (of which I have seen only a single female, in BMNH) or *fasciculata* or, more improbably, to *Scardia amurensis* (Zagulajev) (*q.v.*).

Morophaga hyrcanella Zagulajev

(Fig. 77)

Morophaga hyrcanella Zagulajev, 1966: 639, fig. 3. Holotype ♀, U.S.S.R. (ZI) [examined].
Morophaga talyshensis Zagulajev, 1966: 641, fig. 4. Holotype ♂, U.S.S.R. (ZI) [examined]. [Synonymized by Zagulajev, 1973: 76.]

ADULT (Zagulajev, 1973: pl. 1, fig. 2 (colour); Fig. 77). ♂, 28 mm; ♀, 32 mm. Similarly patterned to *choragella* but frons and vertex more brownish; antennal cilia 4·0 × (♂) or 1·0 × (♀) flagellar diameter; thorax and tegula brown; forewing with dark brown scaling more extensive, forming a V-shaped medial fascia; hindwing grey-brown; legs with dark markings more intense and extensive.

GENITALIA ♂ (Zagulajev, 1966: fig. 4; 1973: fig. 56). Similar to *choragella* but ventral lobe of valva with hook-shaped ventral extension; aedeagus not as strongly curved.

GENITALIA ♀ (Zagulajev, 1966: fig. 3; 1968: fig. 12; 1973: figs 19b, 57). Similar to *choragella* but sclerotization of eighth sternite extended caudally beyond lobes that form lateral margins of ostium.

DISTRIBUTION. U.S.S.R. (Transcaucasus).

BIOLOGY. Described by Zagulajev (1966; 1973: 78).

MATERIAL EXAMINED. 45 ex., pupae.

Holotype ♀ (of *Morophaga hyrcanella*), **U.S.S.R.**: Transcaucasia, Talysh, Lenkoran dist., Sarakh, 19.vii.1964 (*Zagulajev*) (ZI). Holotype ♂ (of *Morophaga talyshensis*), **U.S.S.R.**: Transcaucasia, Talysh, R. Lyakar, nr Mamagon (22 km W. of Pensar), Astara dist., 2100 m, 10.viii.1962 (*Zagulajev*) (ZI).

U.S.S.R.: 1 ♂, 1 ♀, 1 pupa, Talysh, L. Girkanskiy, 20.ix.1967 (*Zagulajev*) (BMNH). Also a further 41 ex., 30 pupae, various Transcaucasian localities (see Zagulajev, 1973: 78) (ZI).

REMARKS. More strongly marked than *choragella, hyrcanella* is also distinguished externally by its larger size and more elongate antennal cilia in both sexes. Differences in genitalia are outlined above.

Morophaga fasciculata sp. n.

(Figs 78, 139, 178)

ADULT (Fig. 78). ♂, 15–18 mm; ♀, 21 mm. Vertex and frons cream. Labial palpus with apical segment uniformly pale, outer surface of second segment evenly flecked with brown. Maxillary palpus cream, some darker scaling above on second segment. Antennal scape whitish; pedicel brown above; flagellum ochreous; cilia 3 × (♂) or 0·5 × (♀) flagellar diameter. Thorax and tegula cream marked with brown, dark brown anteriorly. Forewing cream, patterned with brown (specimens worn and slightly faded), pattern similar to *kobella* and to species of the *sistrata*-group. Hindwing grey. Legs ochreous cream; foreleg and mid-leg brownish above, paler at articulations, mid-tibia with cream medial band; outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·5 length of inner.

GENITALIA ♂ (Fig. 139). Eighth segment with small coremata but no associated apodemes; eighth sternite with broadly U-shaped posterior emargination. Saccus broad, U-shaped, as long as tegumen + uncus; uncus lobes shorter than saccus, simple, only moderately sclerotized, setose. Subscaphium well-sclerotized, rod-like. Juxta small, quadrate, weakly sclerotized; transtilla not developed. Valva with broad, deep emargination; with dense dorsoventral band of slender, flattened scales on outer surface; separate tuft of close-set similar scales on ventral margin; apices of ventral and dorsal lobes serrate, a shallowly dentate ridge running anteriorly down internal face of valva; line of 5 or 6 peg-like spines at apex of costa, smaller peg-like spines on internal face of dorsal lobe. Membranous lobe at base of valva elongate, densely hirsute. Aedeagus short, 7 × as long as broad, with three lobate anteriorly-directed carinae; vesica with minute, inconspicuous spicular cornuti.

GENITALIA ♀ (Fig. 178). Eighth tergite slightly longer than eighth sternite; eighth sternite short, with lateral membranous pouches in intersegmental membrane, caudal margin produced into pair of short lateral processes either side of ostium, each process with about 6 strong apical setae. Antrum broad, thick-walled, almost twice length of eighth sternite, with ill-defined longitudinal ridging. Ductus bursae + corpus bursae thin-walled, contiguous, elongately pear-shaped.

DISTRIBUTION. Japan.

BIOLOGY. The type-species was bred from the fungus *Trametes kusanoana* Imazeki, adults emerging in late June and early July.

MATERIAL EXAMINED. 4 ex.

Holotype ♂, **Japan**: Honshu, Nara, bred from *Trametes kusanoana* Imazeki, coll. 29.vi.1965, em. 4.vii.1965 (*Arita*) (genitalia slide no. 1048 [Robinson]; coll. S. Moriuti, Osaka).

Paratypes. 2 ♂, 1 ♀, data as holotype but em. 2.vii. and 30.vi.1965 (genitalia slide no. 1049 [Robinson]; coll. S. Moriuti, Osaka; BMNH).

REMARKS. Similarities between the male genitalia of *fasciculata*, *choragella* and *hyrcanella* are marked, but *fasciculata* is distinctive in lacking the strong, articulated hook-like process set in the valva of the last two species. The deep emargination of the valva that accommodates the hook in the other two species is also present in *fasciculata*. Neither *choragella* nor *hyrcanella* possess the distinctive bundle of close-set flattened scales on the ventral margin of the valva that is present in *fasciculata*. Females of *fasciculata* are very similar externally to *kobella*. Separation of the two species, while simple enough using genitalic characters (the antrum of *kobella* is longer than the apophyses anteriores, but considerably shorter in *fasciculata*), is unsafe using external characteristics only, to judge from the material presently available. Comparison of fresh material of the two species may, however, reveal perfectly good pattern differences.

Morophaga kobella sp. n.

(Figs 79, 177)

ADULT (Fig. 79). ♀, 23 mm. (Specimen slightly faded and badly discoloured by fine, dark dust.) Vertex and frons cream. Labial palpus cream flecked with dark brown, but whitish on inner surface. Maxillary palpus cream flecked with brown; dark brown scales above on second segment. Antennal scape cream flecked with brown; pedicel similar; flagellum medium brown; cilia 0·5 × flagellar diameter. Thorax and tegula cream flecked with brown, dark brown anteriorly. Forewing cream marked with orange-brown, medium brown and dark brown, pattern similar to that of *choragella* but dark costal markings denser, better-defined, antemedial costal spot not as elongate. Hindwing charcoal grey. Legs cream flecked with brown; foreleg and mid-leg strongly marked with dark brown above but cream at articulations; mid-tibia with

cream medial band; hind spurs strongly marked with dark brown; outer mid-tibial spur 0·4 length of inner; outer proximal hind tibial spur 0·5 length of inner.

GENITALIA ♂. Unknown.

GENITALIA ♀ (Fig. 177). Eighth tergite broad, shield-shaped, slightly longer than eighth sternite, with subapical row of 4 strong setae surrounded by numerous scattered smaller setae. Eighth sternite broad, strongly sclerotized, with rectangular medial emargination posteriorly; lobes either side of emargination each with 3 apical setae; anteriorly, surface of sternite strongly ridged and folded to form strong ventral keel. Antrum smooth-surfaced posteriorly, further anteriorly thick-walled with strong longitudinal ridges on inner surface, extending beyond apices of apophyses anteriores. Ductus bursae short, convoluted, offset to the left. Corpus bursae elongately ovoid; signa absent.

DISTRIBUTION. Japan.

BIOLOGY. Unknown.

MATERIAL EXAMINED. 1 ex.
Holotype ♀, **Japan**: [Honshu], Kobe, 6.vii.1927 (*Lewis*) (genitalia slide no. 13116; BMNH).

REMARKS. The external apperance of *kobella* is similar to that of members of the *choragella*-group (*choragella*, *fasciculata*) and the *sistrata*-group (*sistrata*, *formosana*, *iriomotensis*). The bursa copulatrix is as elongate as in members of the *sistrata*-group but the antrum is internally ridged, as in the *choragella*-group. The tibial spurs are of a length comparable with that of members of the *choragella*-group rather than the *sistrata*-group. However, the present placement of *kobella* should be considered provisional until the male is discovered. This species may be separated from all other *Morophaga* species by its enormously elongate antrum.

Taxa incertae sedis

LEPTOZANCLA Meyrick

Leptozancla Meyrick, 1920: 107. Type-species: *Leptozancla talaroscia* Meyrick, 1920: 108, by original designation and monotypy.

This genus was redescribed by Gozmány & Vári (1973) and by Robinson (1976*a*). The single species here included, *L. talaroscia* Meyrick, was described by Meyrick (1920: 107) from two males from Mt Kenya, both in poor condition. No further specimens of *Leptozancla* have been identified since its original description. In the absence of further material, the taxonomic position of *Leptozancla* must remain in doubt. However, it is probably a scardiine. Gozmány & Vári (1973) and Robinson (1976*a*) treated *Philagrias* (see below) as a synonym of *Leptozancla*. However, in the light of the morphological differences between other scardiine genera this synonymy is not appropriate.

L. talaroscia has densely ciliate antennae, the cilia as long as the flagellar diameter. The genitalia are characterized by the valvae having been apparently entirely supplanted by the juxta as no typical valval apodeme is evident: the juxta (if, indeed, the structure is the juxta) forms a ventral complex resembling a pair of entirely fused valvae. The transtilla (and, possibly, remnants of the valval apodemes) forms a strongly sclerotized complex with four elongate and posteriorly-directed spines (labides) (Robinson, 1976*a*: fig. 65).

PHILAGRIAS Meyrick **gen. rev.**

Philagrias Meyrick, 1932*a*: 119. Type-species: *Philagrias zelotica* Meyrick, 1932*a*: 119, by monotypy.

The single species included here, *P. zelotica*, has been redescribed by Gozmány & Vári (1973) and by Robinson (1976*a*). It was described from a single male example in poor condition from the highlands of Ethiopia. No further specimens of *Philagrias* have been identified since its original description. In the absence of further material, its taxonomic position must remain in doubt. However, it is probably a scardiine.

Philagrias is distinguished by the antennae having very short cilia (0·5 × the flagellar diameter) which lie almost parallel to the axis of the flagellum. Previous authors have recorded that *Philagrias* lacks antennal cilia. The 'valva' bears extraordinarily large and complicated processes (?labides) arising from the modified valval apodemes (Robinson, 1976*a*: fig. 66). It is not certain whether the valva is present and forms part of a valve-juxta complex or whether it has been supplanted entirely by the juxta. In previous papers (1976*a*; 1981) I have assumed the structure to be the juxta on the grounds that no recognizably functional remnant of the valval apodeme remains.

Scardia tholerodes Meyrick

Scardia tholerodes Meyrick, 1894: 27. Syntypes, 3 ex., BURMA (?BMNH) [not found, not examined].

Other specimens collected at Koni in the Shan States by Manders and described by Meyrick in the same paper as *tholerodes* are in the BMNH collection (*ex* Meyrick collection). No specimens of *tholerodes* have been found, however. From Meyrick's original description, this taxon may be a member of the *Morophaga sistrata*-group.

Scardia pharetrodes Meyrick

Scardia pharetrodes Meyrick, 1934: 42. Holotype ♀, CHINA (?MNHU) [not found, not examined].

The whereabouts of the holotype of this species are in doubt: according to the original description it should be in MNHU, Berlin. However, it has not been mentioned by Petersen who has had access to the Berlin collections. Neither has it turned up in the Caradja collection of MINGA, Bucharest, despite a search on my behalf by Dr A. Popescu-Gorj. The possible affinities of this taxon are not evident from Meyrick's original description.

Scardia isthmiella Busck

Scardia isthmiella Busck, 1914: 65. Holotype ♀, PANAMA (NMNH) [examined].

The holotype of this species is in poor condition. It resembles superficially a *Daviscardia* species but the pale scaling of the terminal fascia does not extend along the dorsum. Davis (in prep.) will publish a description and illustration of it. The genitalia are nondescript, the eighth sternite hardly sclerotized, the ventral margin of the ostium lined with small setae and with a doubly crescentic outline (very shallowly m-shaped). The ductus bursae has irregular transverse constrictions in its posterior two-thirds and extends to two-thirds the length of the apophyses anteriores. The corpus bursae is small and ovate and lacks signa.

MATERIAL EXAMINED. 1 ex.
Holotype ♀, **Panama**: Porto Bello, v.1912 (*Busck*) (genitalia slide no. 20155; NMNH).

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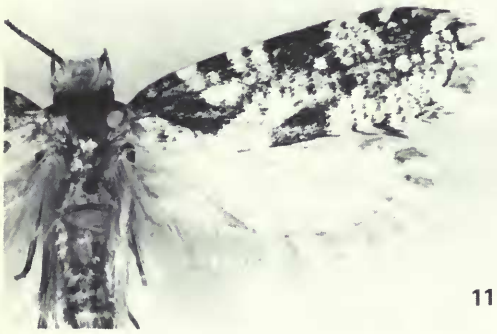

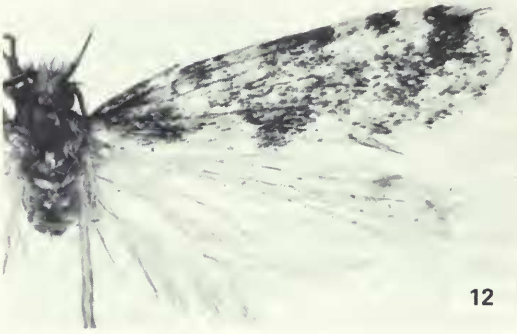

Figs 9–16 *Morophagoides* species. 9, *iranensis,* ♂; 10, *ussuriensis,* ♂; 11, *moriutii,* ♂ paratype; 12, *berkeleyella,* ♂ (Burney Mt.); 13, *burkerella,* ♂; 14, *montium,* ♀ holotype; 15, *pythium,* ♀ holotype; 16, *nimbiferum,* ♀ holotype.


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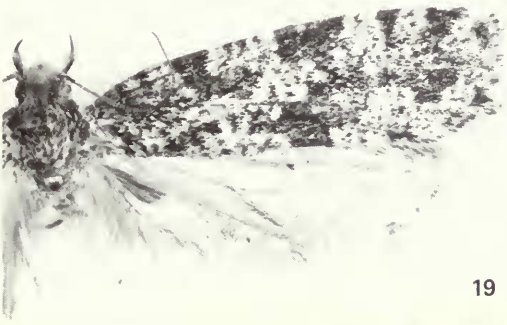
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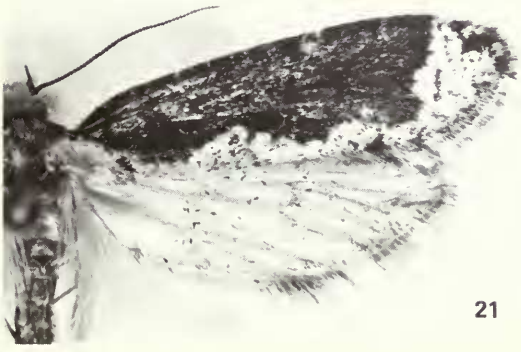
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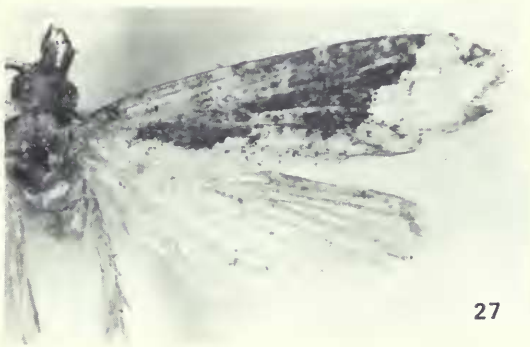
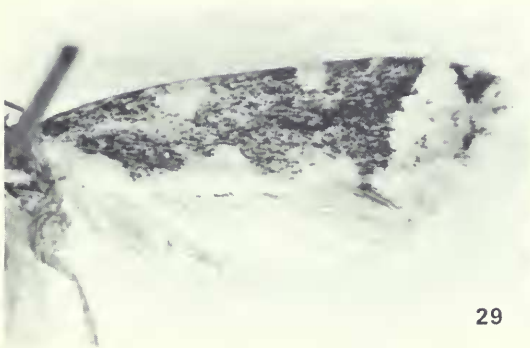
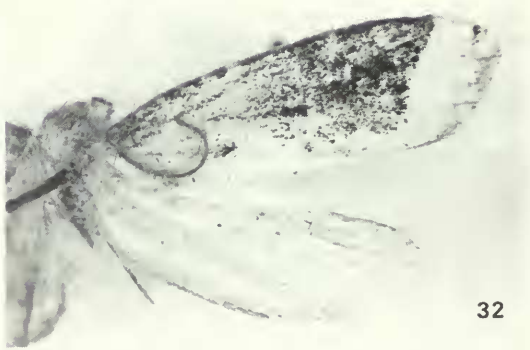
Figs 17–24 17, *Morophagoides iulina,* ♂ holotype. 18, 19, *Montescardia* species. 18, *tessulatellus,* ♀; 19, *fuscofasciella,* ♀ (North Carolina). 20, *Bythocrates drosocycla,* ♀. 21–24, *Daviscardia* species. 21, *coloradella,* ♀; 22, *radulella,* ♂ holotype; 23, *bimendella,* ♂ lectotype; 24, *beckeri,* ♂ holotype.







Figs 25–32 *Daviscardia* species. 25, *beckeri,* ♀ paratype; 26, *luctuosa,* ♂ lectotype; 27, *mackiei,* ♂ holotype; 28, *mackiei,* ♂ paratype; 29, *mackiei,* ♀; 30, *bicolorella,* ♂ paratype; 31, *lupulella,* ♀ holotype; 32, *hypocritella,* ♀ holotype.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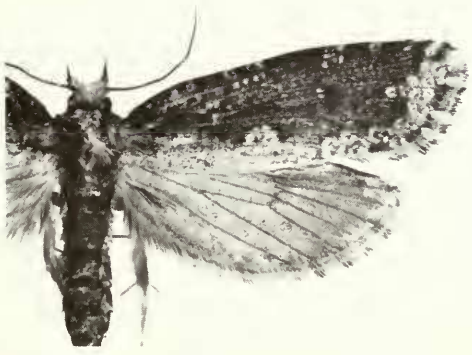
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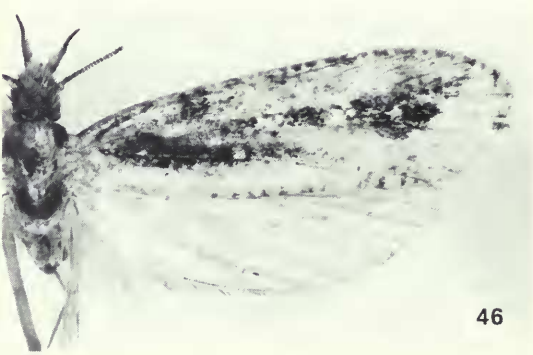
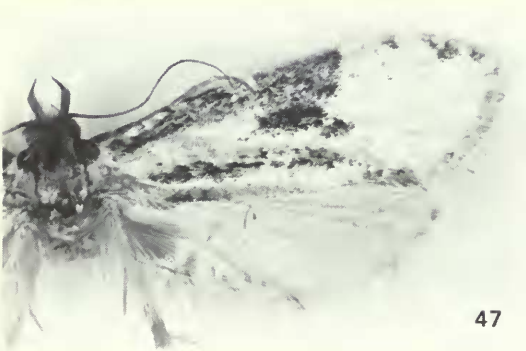
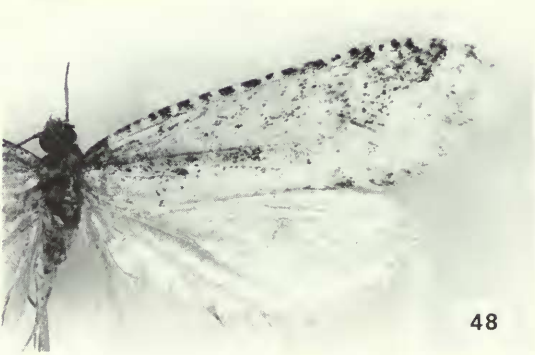
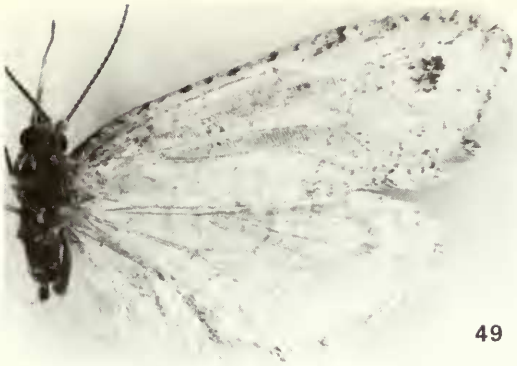
Figs 33–40 33–39, *Scardia* species. 33, *anatomella,* ♀ lectotype; 34, *anatomella,* ♂ (Venezuela); 35, *assamensis,* ♂ holotype; 36, *amurensis,* ♀; 37, *alleni,* ♀ holotype; 38, *boletella*, ♀; 39, *caucasica*, ♀ paratype. 40, *Perilicmetis diplaca,* ♂ paratype.







Figs 41–48 41, 42, *Moscardia* species. 41, *renitens,* ♂ holotype; 42, *varna,* ♂ holotype. 43, *Gentingia hollowayi,* ♂ holotype. 44, *Semeoloncha penicillata,* ♂ holotype. 45–47, *Cranaodes* species. 45, *stereopa,* ♀; 46, *oroya,* ♂ holotype; 47, *sequestrata,* ♀. 48, *Pectiniscardia prostylias,* ♂ holotype.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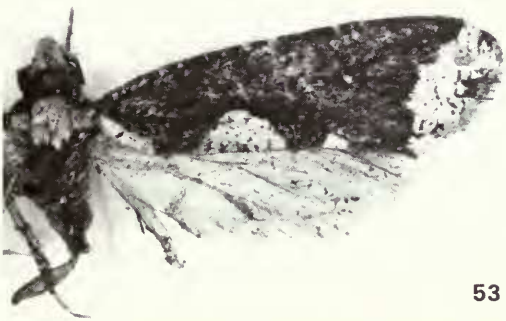
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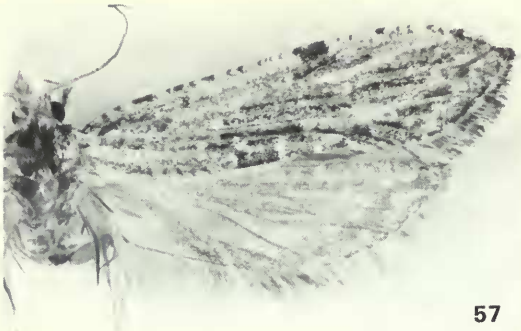
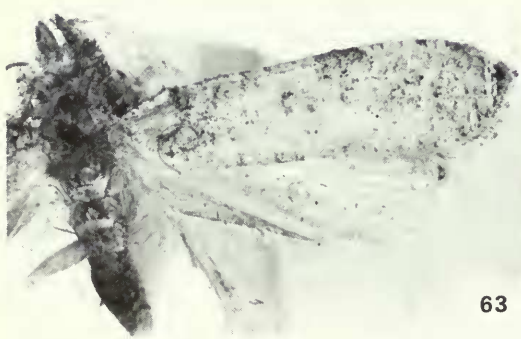
Figs 49–56 49, *Hormantris astragalopa,* ♂ holotype. 50, *Cnismorectis choritica,* ♂. 51, *Afroscardia capnochalca,* ♂ holotype. 52, *Scardiella approximatella,* ♀. 53, 54, *Necroscardia* species. 53, *funeratella,* ♂ lectotype; 54, *morticina,* ♂ holotype. 55, 56, *Miniscardia* species. 55, *minimella*, ♂ (Costa Rica); 56, *minimella*, ♀ (Costa Rica).





Figs 57–64 57–59, *Amorophaga* species. 57, *rosemariae,* ♀ holotype; 58, *cryptophori,* ♂; 59, *japonica,* ♂ holotype. 60–64, *Diataga* species. 60, *leptosceles,* ♂ lectotype; 61, *frustraminis,* ♂ paratype; 62, *brasiliensis*, ♂ holotype; 63, *compsacma,* ♂ paralectotype; 64, *levidensis*, ♂ holotype.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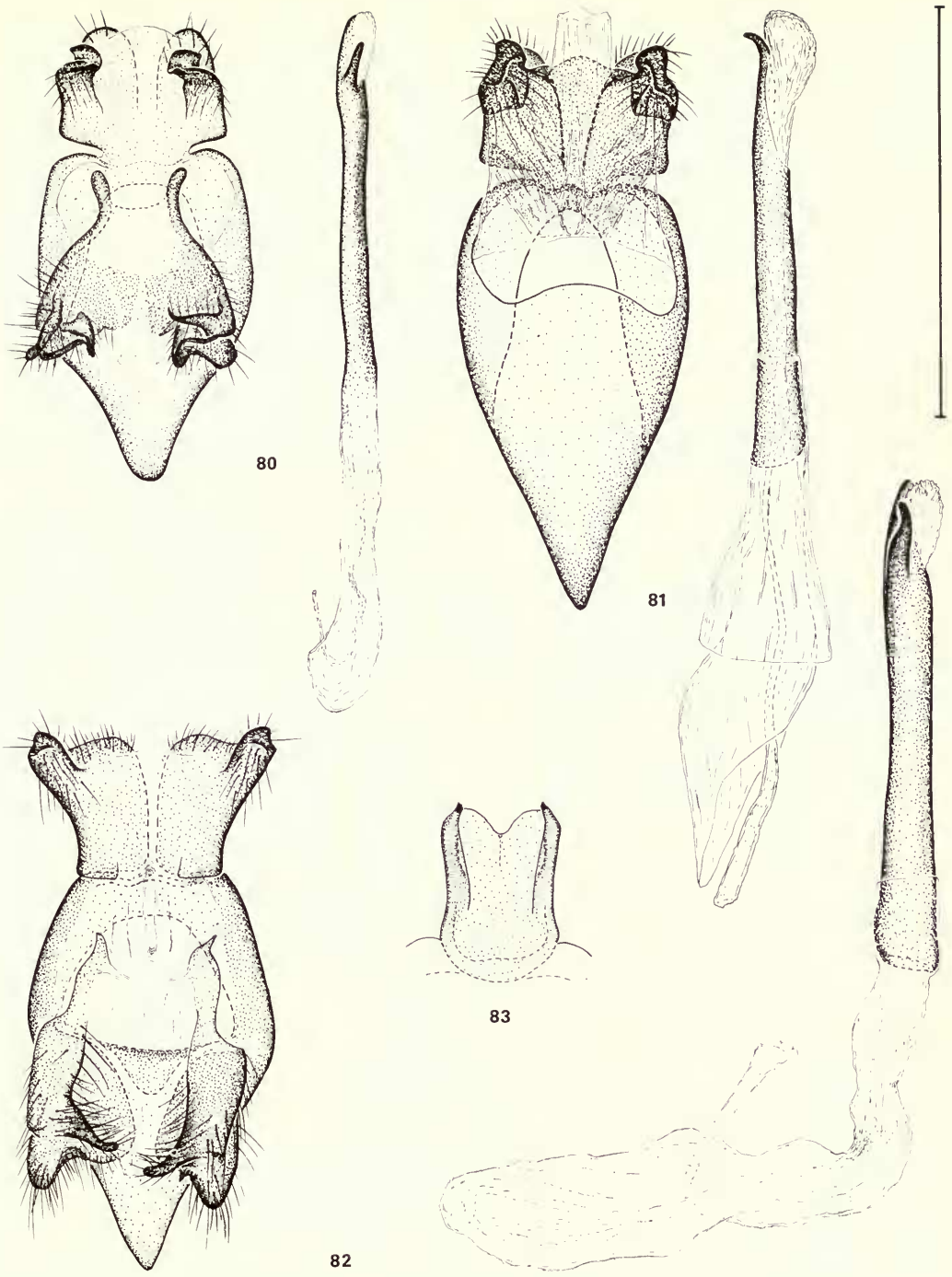
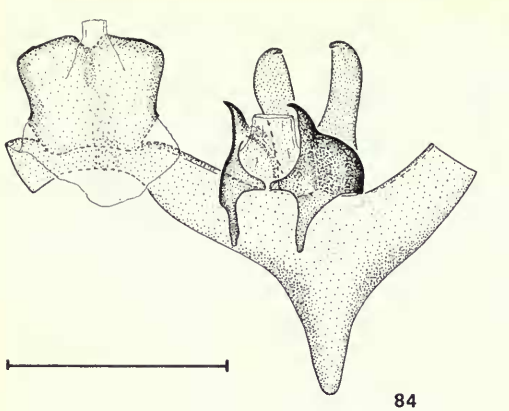
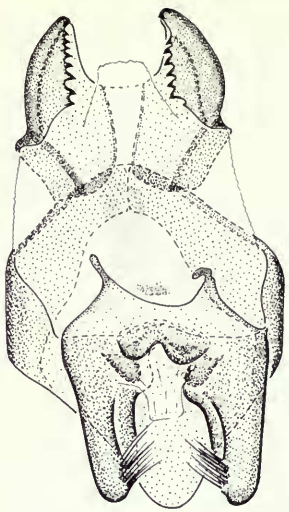
Figs 65–72 65, 66, *Diataga* species. 65, *mercennaria*, ♂ holotype; 66, *direpta*, ♀ paratype. 67–72, *Morophaga* species. 67, *cremnarcha*, ♂ lectotype; 68, *bucephala*, ♀ (Japan); 69, *soror*, ♂ (Sierra Leone); 70, *vadonella*, ♀; 71, *morellus*, ♀ (syntype of *fungicolella*); 72, *borneensis*, ♂ holotype.

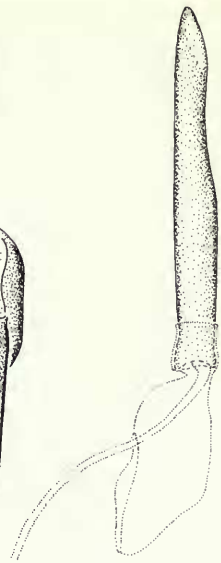
Figs 73–79 *Morophaga* species. 73, *sistrata*, ♂ lectotype; 74, *formosana*, ♂ holotype; 75, *clonodes*, ♀; 76, *choragella*, ♀; 77, *hyrcanella*, ♂; 78, *fasciculata*, ♂ holotype; 79, *kobella*, ♀ holotype.

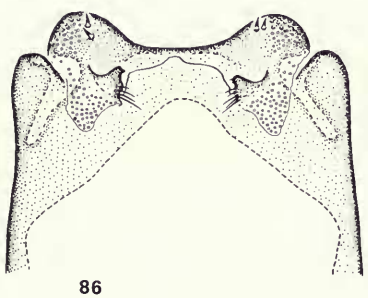


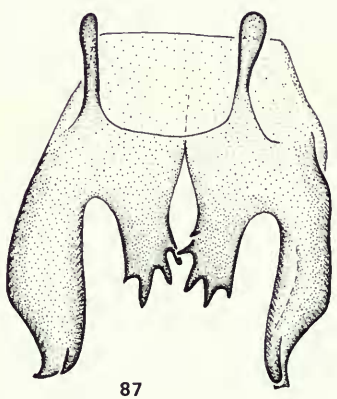
Figs 80–83 Male genitalia of *Morophagoides* species. 80, *ussuriensis*; 81, *moriutii*, paratype (Japan); 82, *moriutii* (Taiwan); 83, *berkeleyella* – uncus. Scale line = 1 mm.

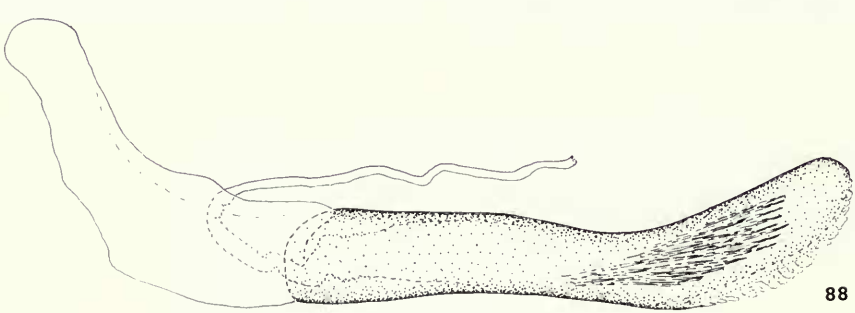




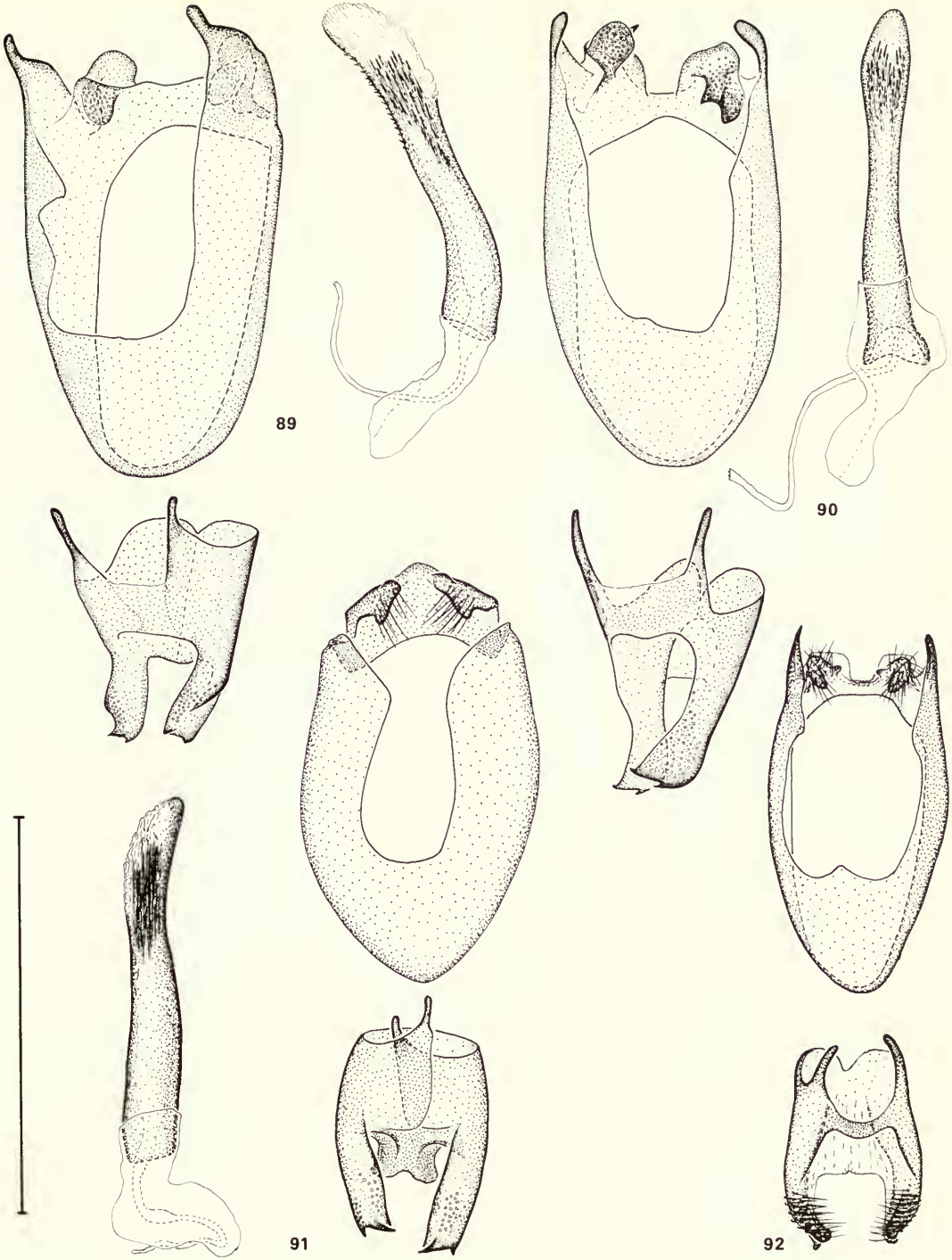




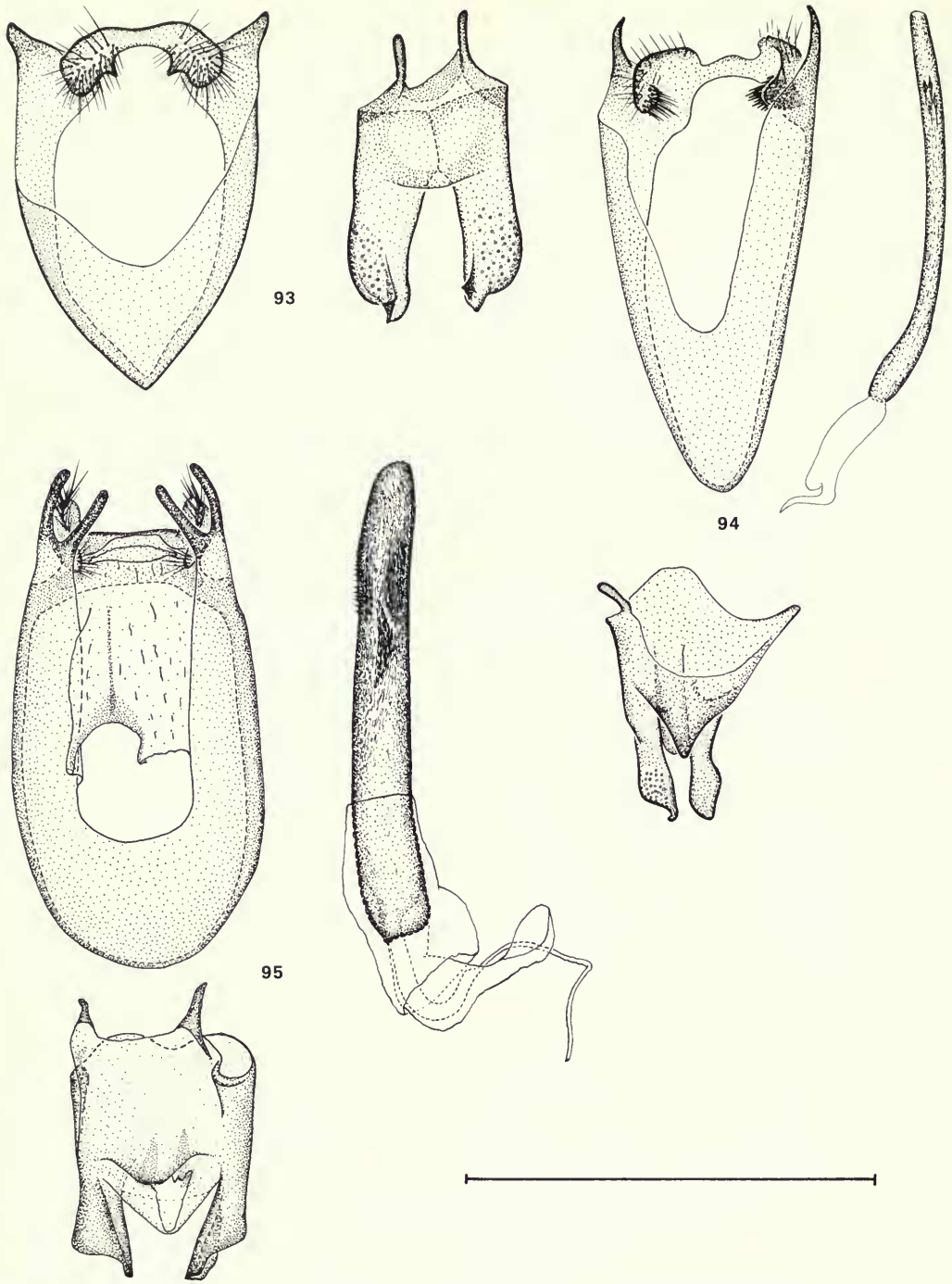




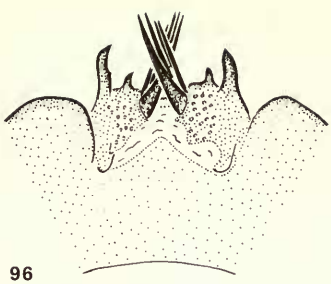
Figs 84–88 Male genitalia. 84, 85, *Morophagoides* species. 84, *burkerella* (note reduced scale); 85, *iulina*, holotype. 86–88, *Daviscardia coloradella*. 86, uncus and tegumen; 87, valvae; 88, aedeagus. Scale line = 1 mm.



Figs 89–92 Male genitalia of *Daviscardia* species (fused valvae detached). 89, *luctuosa,* lectotype; 90, *bimendella*, lectotype; 91, *radulella,* holotype; 92, *beckeri,* holotype. Scale line = 1 mm.



Figs 93–95 Male genitalia of *Daviscardia* species (fused valvae detached). 93, *mackiei*, paratype; 94, *bicolorella*, holotype; 95, unnamed species (Mexico). Scale line = 1 mm.



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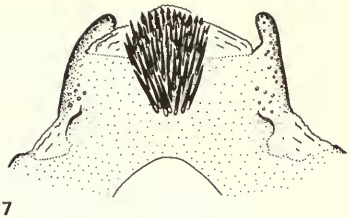

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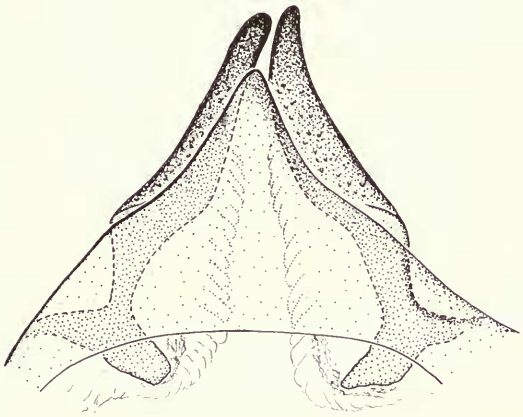

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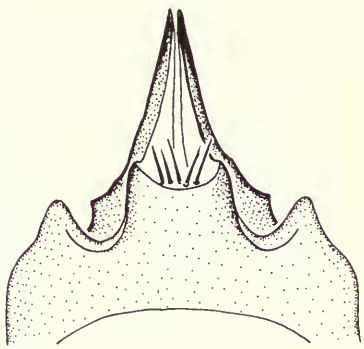

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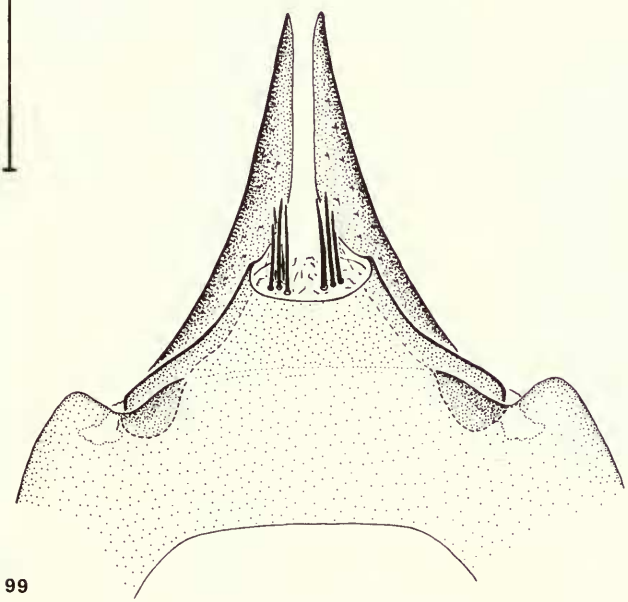

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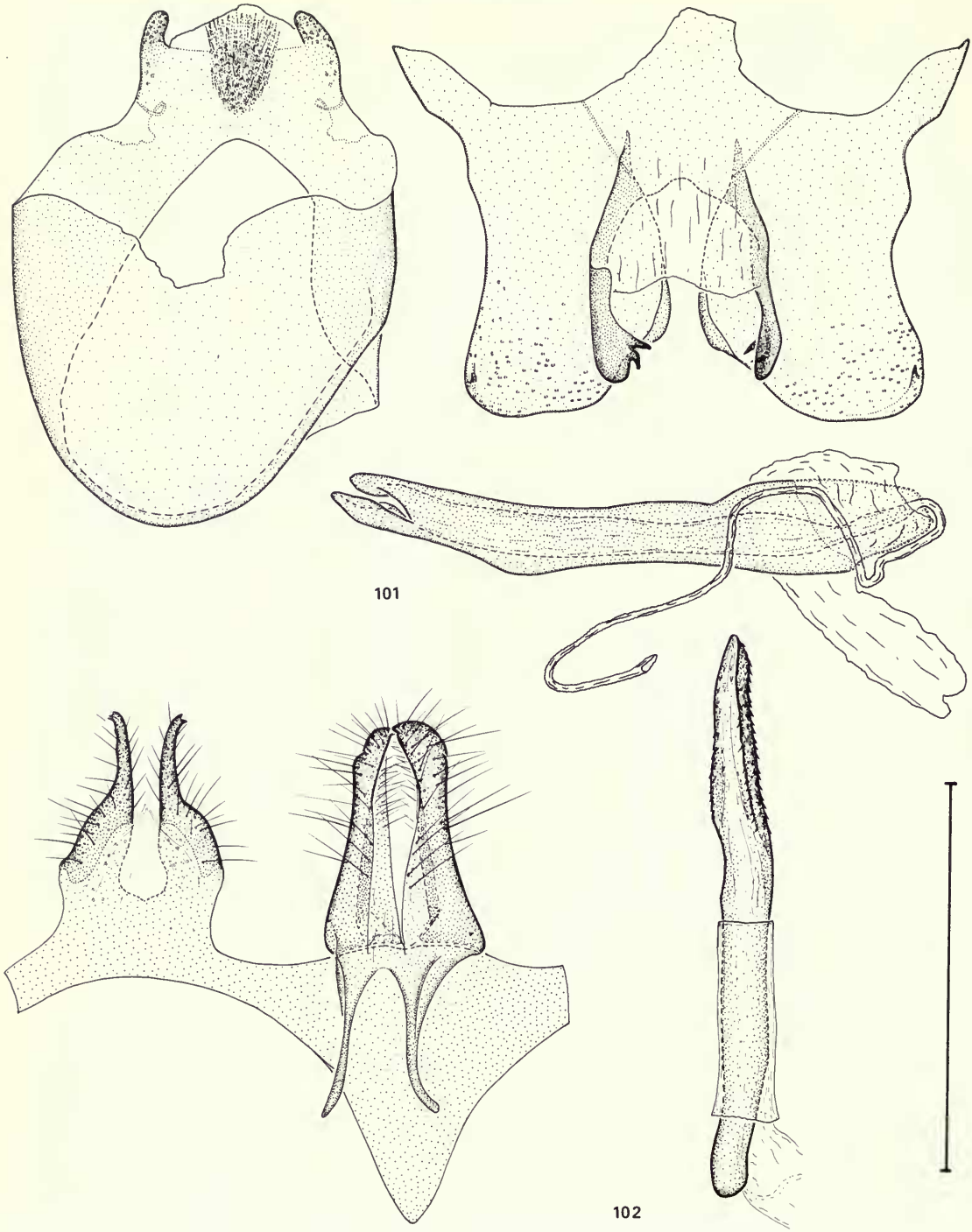
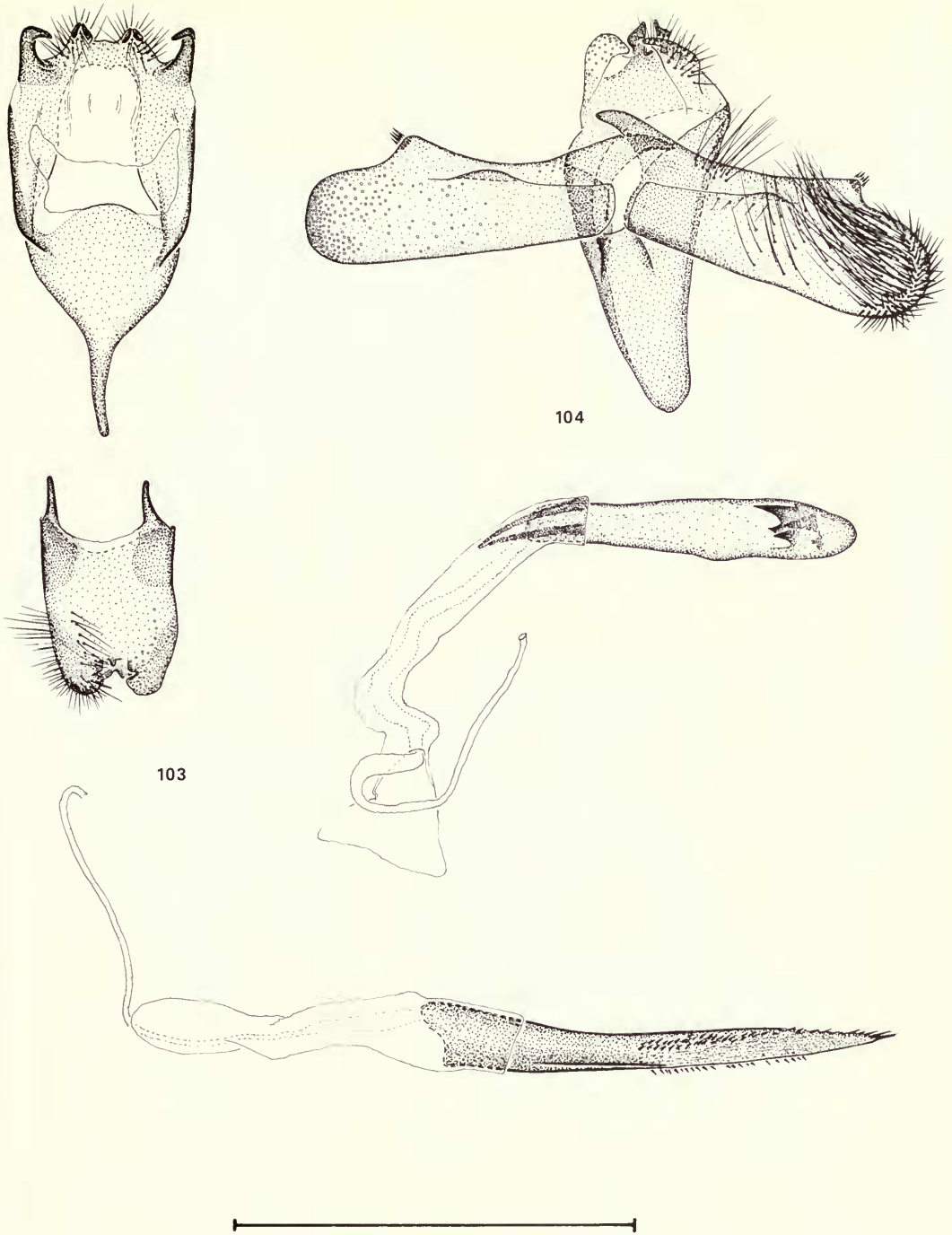
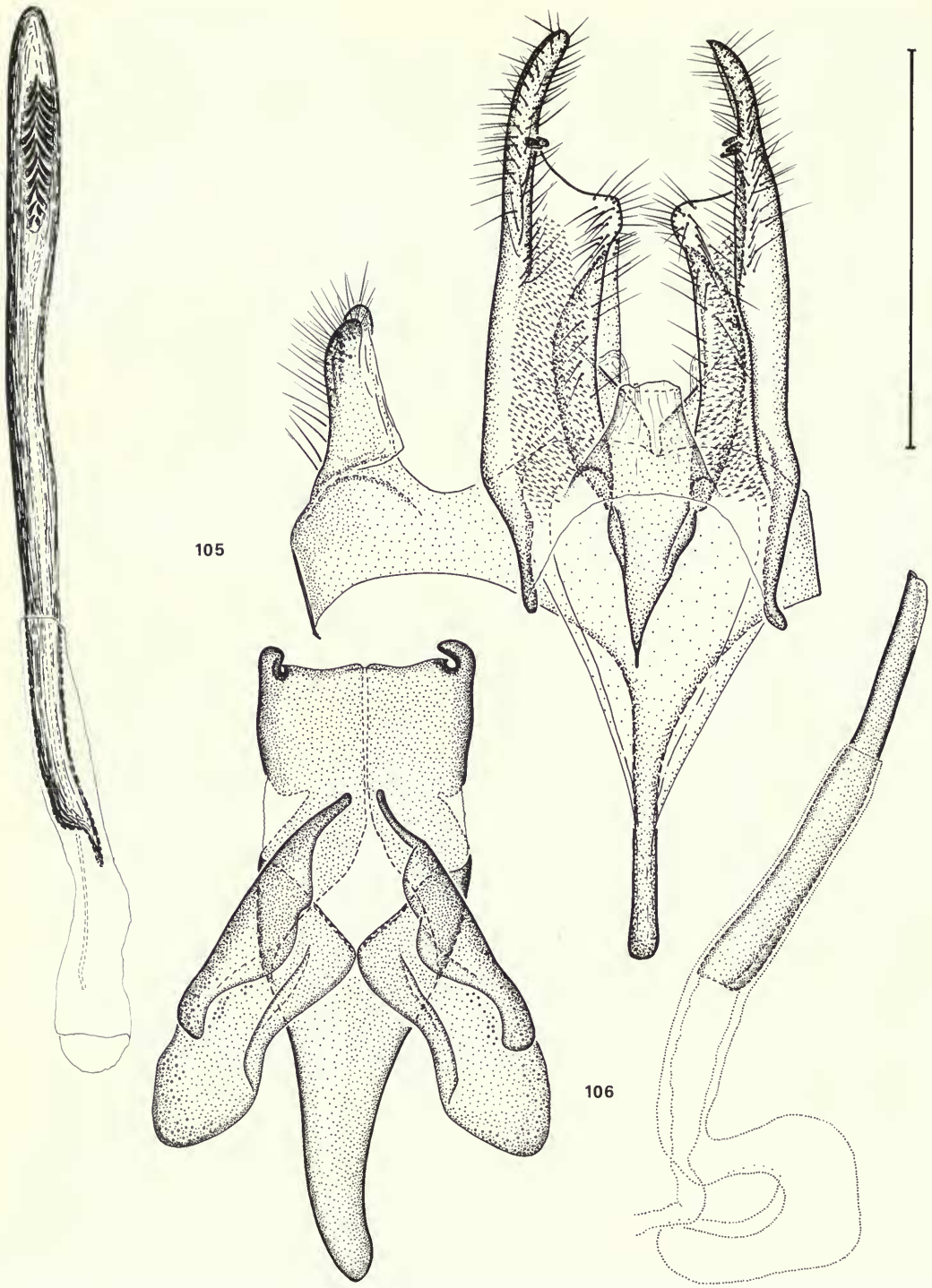
Figs 96–100 Male genitalia – dorsal view of uncus lobes and tegumen of *Scardia* species. 96, *anatomella*; 97, *assamensis*, holotype; 98, *amurensis*; 99, *boletella*; 100, *caucasica* (after Zagulajev, 1973). Scale line = 1 mm.



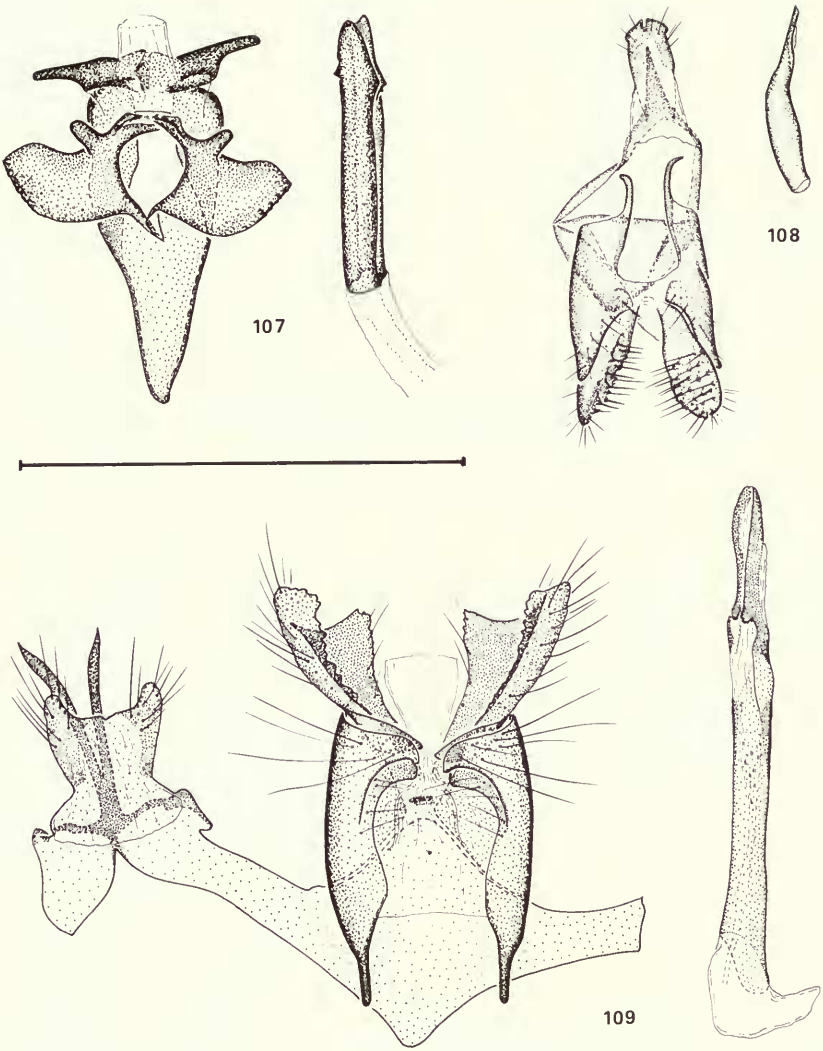
Figs 101, 102 Male genitalia. 101, *Scardia assamensis,* holotype (fused valvae detached); 102, *Perilicmetis diplaca*. Scale line = 1 mm.



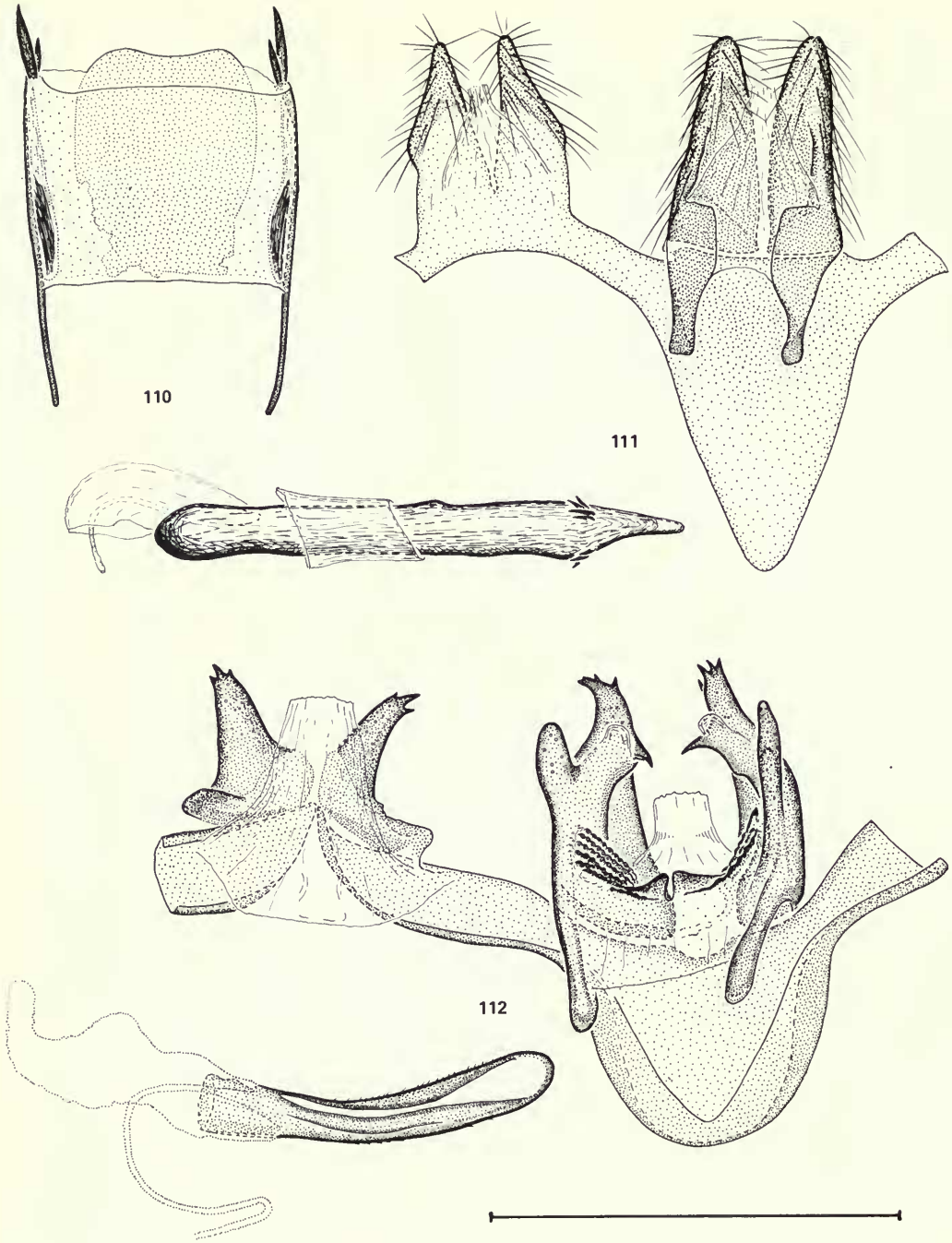
Figs 103, 104 Male genitalia. 103, *Gentingia hollowayi,* holotype (fused valvae detached); 104, *Moscardia varna,* holotype. Scale line = 1 mm.



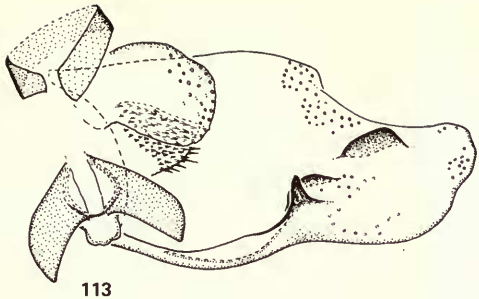
Figs 105, 106 Male genitalia. 105, *Cnismorectis choritica*; 106, *Cranaodes oroya,* holotype. Scale line = 1 mm.



Figs 107–109 Male genitalia. 107, *Scardiella approximatella.* 108, 109, *Necroscardia* species. 108, *funeratella,* lectotype; 109, *morticina,* holotype. Scale line = 1 mm.



Figs 110–112 Male genitalia. 110, *Necroscardia funeratella,* lectotype – modified eighth abdominal segment; 111, *Miniscardia minimella* (Costa Rica); 112, *Amorophaga japonica,* holotype. Scale line = 1 mm.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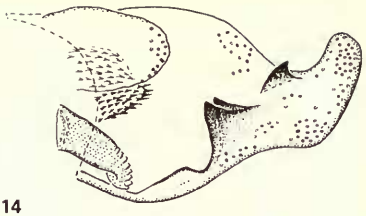
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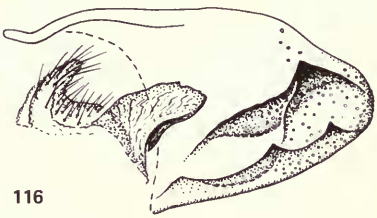
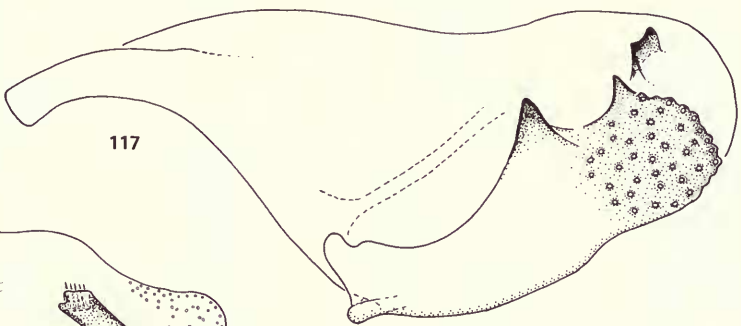
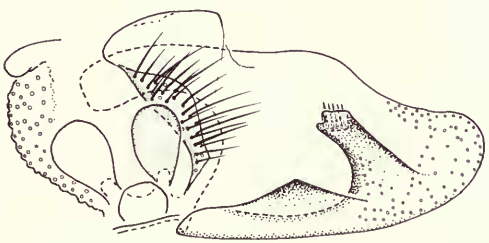
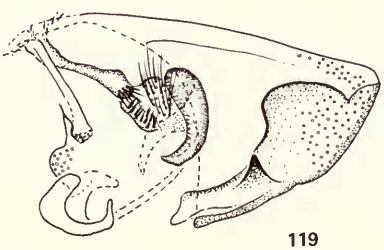
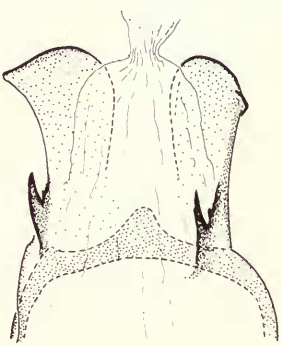
115


116

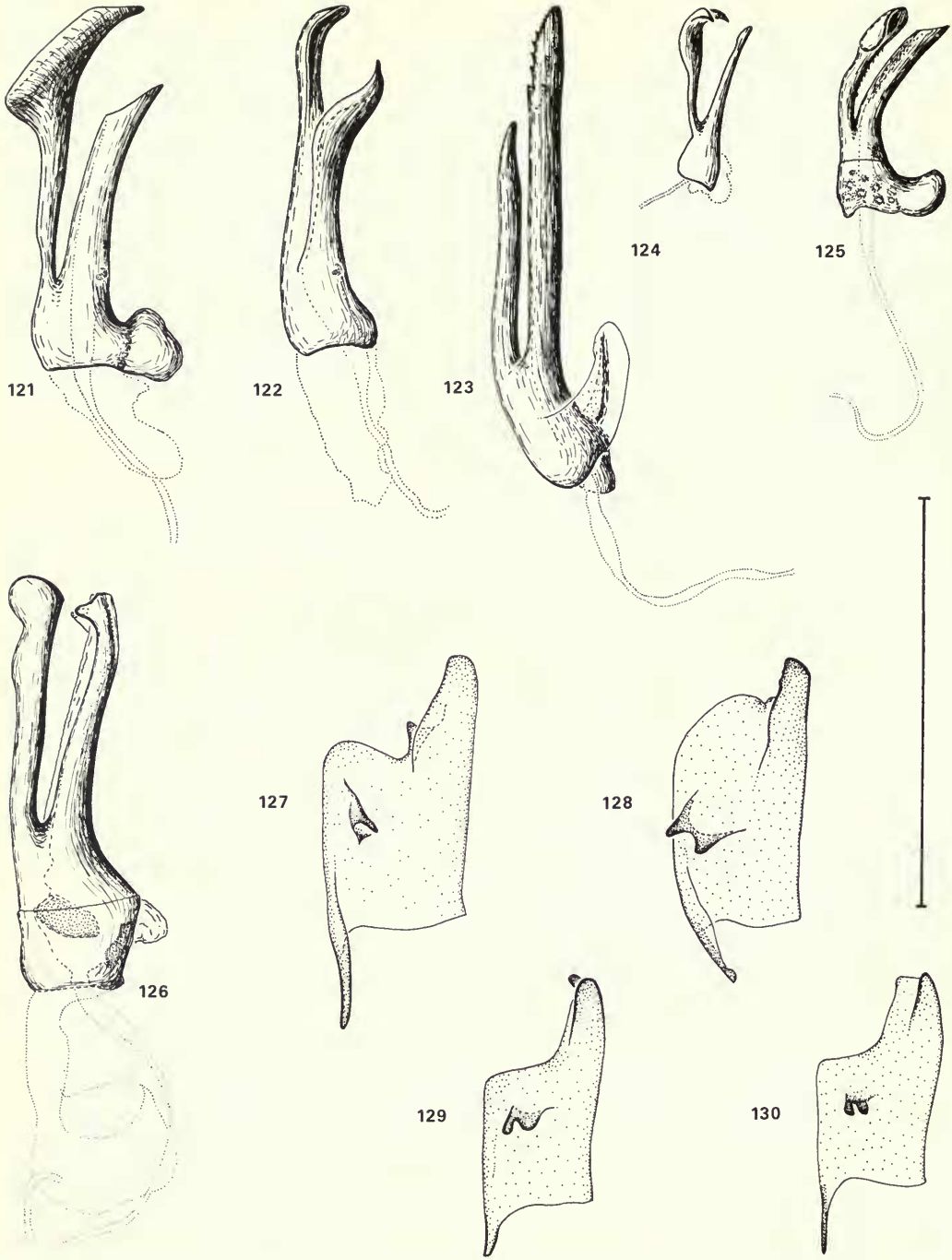

117


118

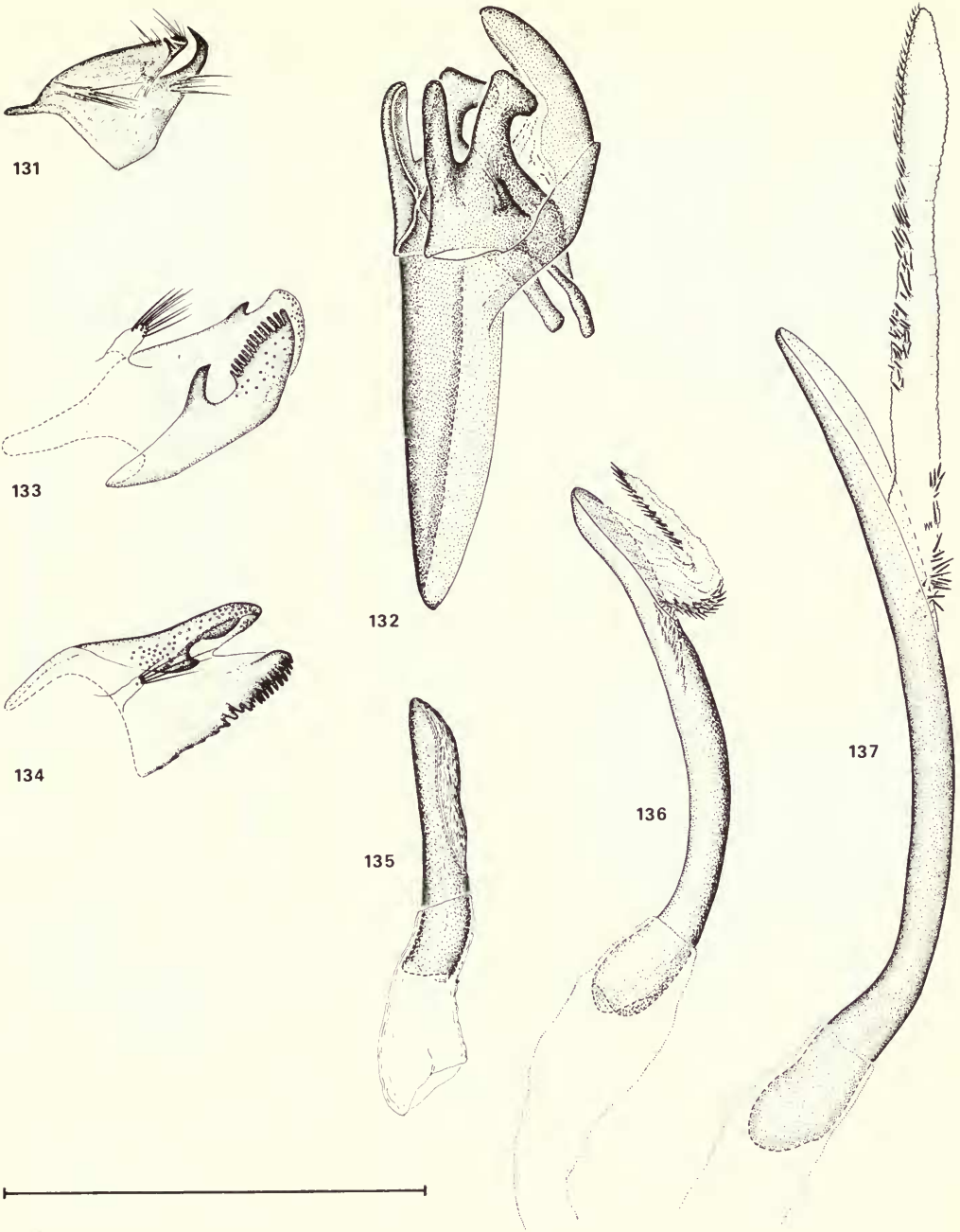

119


120

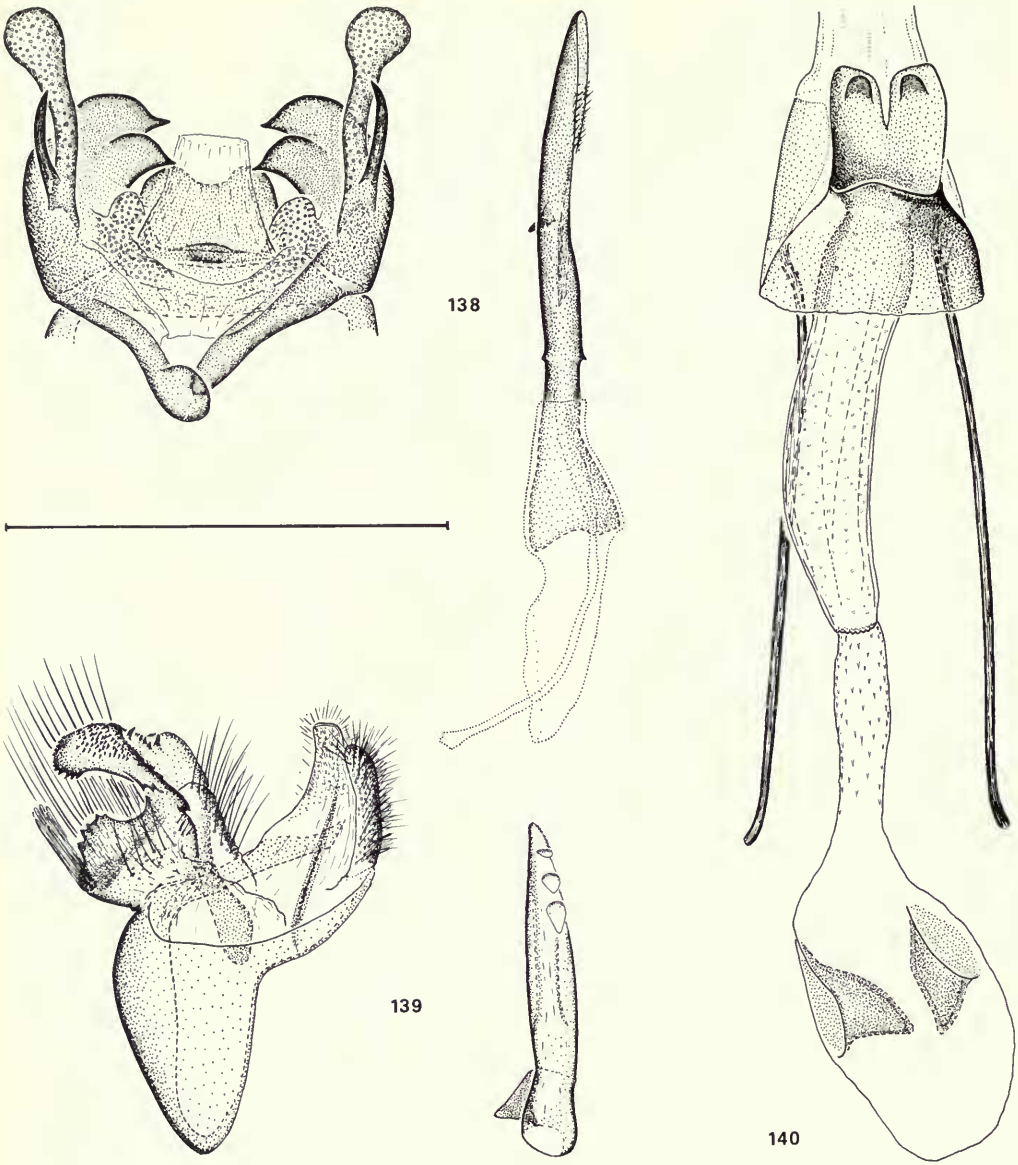
Figs 113–120 Male genitalia of *Diatagа* species (113–119, right valva with juxta-transtilla complex; 120, ventral view of uncus lobes). 113, *leptosceles,* lectotype; 114, *leptosceles* (Brazil); 115, *frustraminis,* holotype; 116, *brasiliensis,* holotype; 117, *compsacma,* lectotype (juxta-transtilla region destroyed); 118, *levidensis,* holotype; 119, 120, *mercennaria*, holotype. Mixed scales, 117 greatly enlarged.



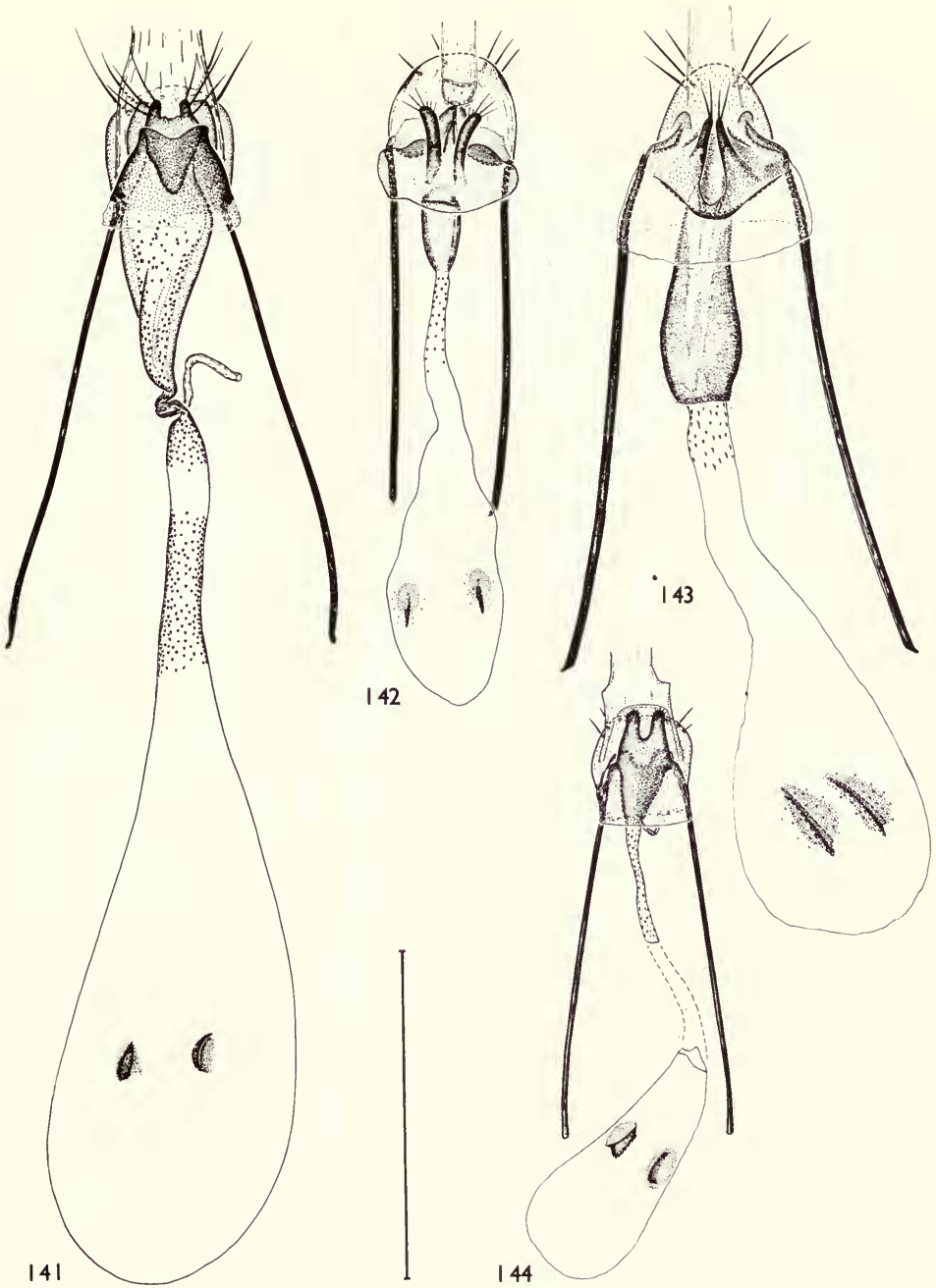
Figs 121–130 Male genitalia (121–126, aedeagus; 127–130, right valva). 121–126, *Diataga* species. 121, *leptosceles*, lectotype; 122, *frustraminis*, holotype; 123, *brasiliensis*, holotype; 124, *compsacma*, lectotype; 125, *levidensis*, holotype; 126, *mercennaria*, holotype. 127–130, *Morophaga* species. 127, *cremnarcha*; 128, *bucephala*; 129, *soror*; 130, *vadonella*, holotype. Scale line = 1 mm.



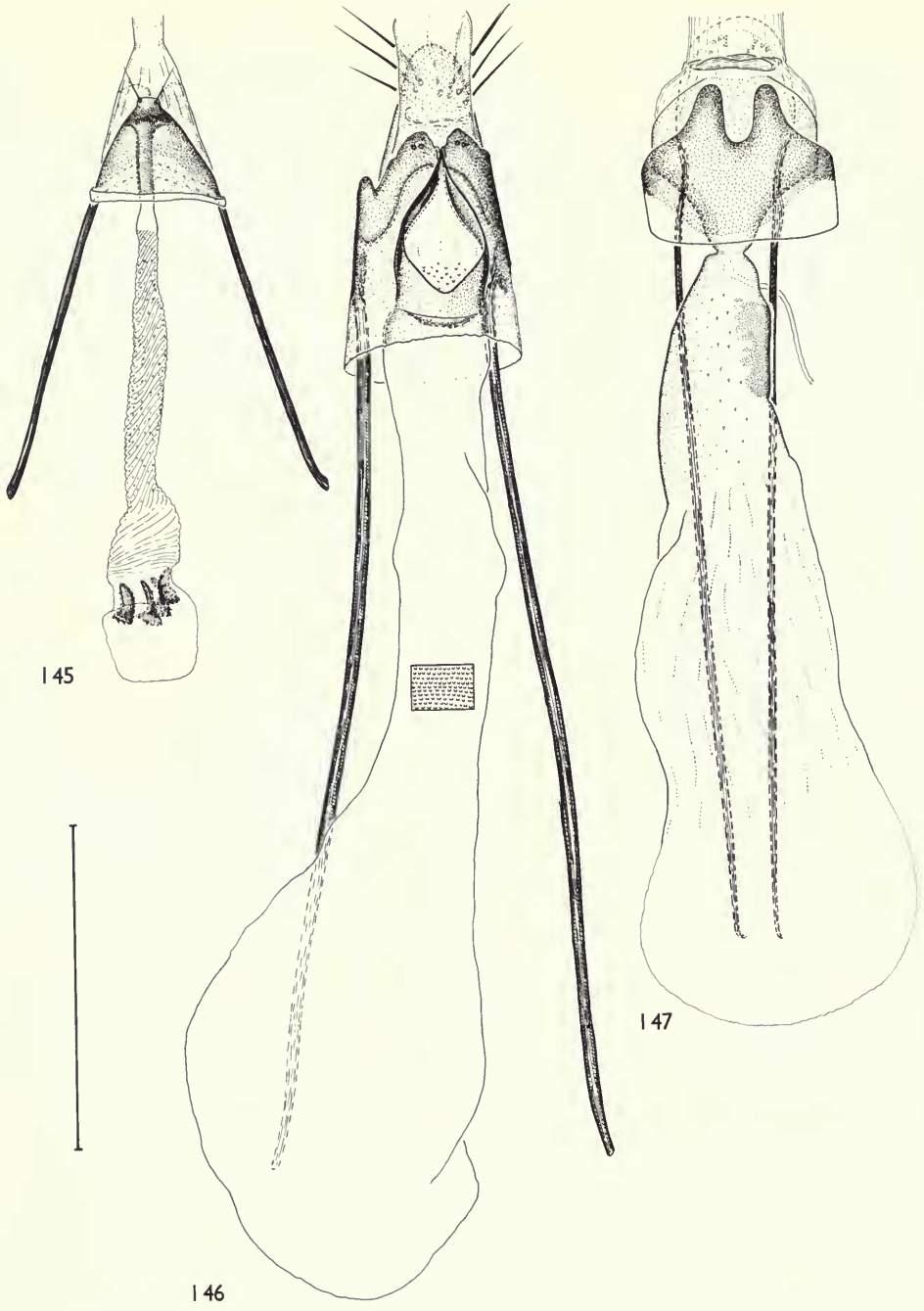
Figs 131–137 Male genitalia of *Morophaga* species (131, 133, 134 – right valva; 135–137 – aedeagus). 131, *borneensis,* holotype; 132, *sistrata*; 133, *formosana,* holotype; 134, *iriomotensis,* holotype; 135, *borneensis,* holotype; 136, *sistrata*; 137, *formosana,* holotype. Scale line = 1 mm.



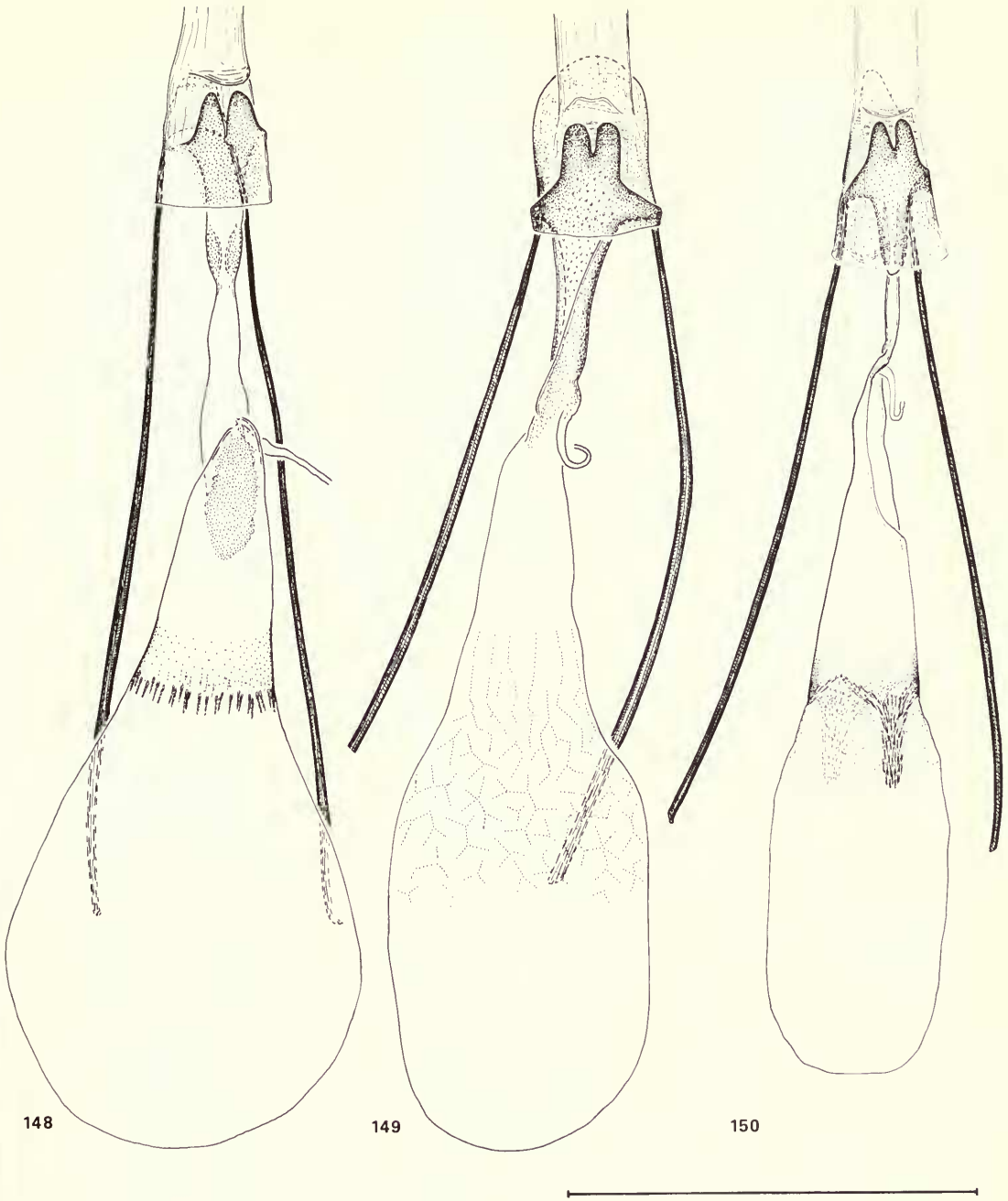
Figs 138–140 138, 139, male genitalia of *Morophaga* species. 138, *clonodes*; 139, *fasciculata*, holotype. 140, female genitalia of *Morophagoides burkerella*. Scale line = 1 mm.



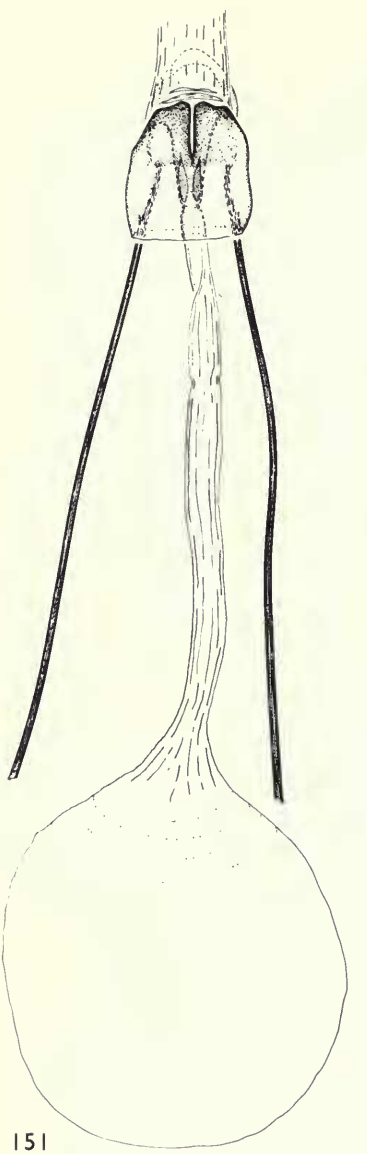
Figs 141–144 Female genitalia of *Morophagoides* species. 141, *moriutii* (Taiwan); 142, *nimbiferum*, holotype; 143, *pythium,* holotype; 144, *montium,* holotype. Scale line = 1 mm.

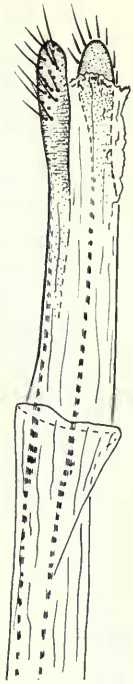


Figs 145–147 Female genitalia. 145, *Bythocrates drosocycla*; 146, *Montescardia fuscofasciella,* lectotype; 147, *Daviscardia coloradella.* Scale line = 1 mm.

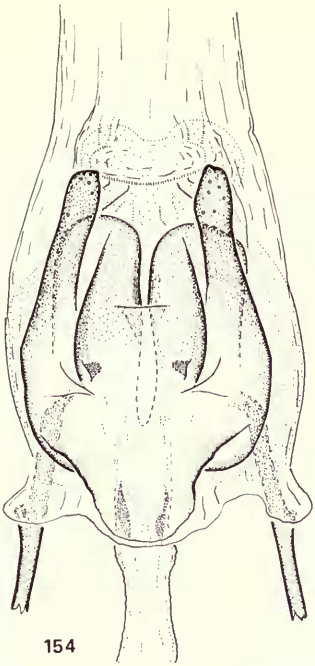


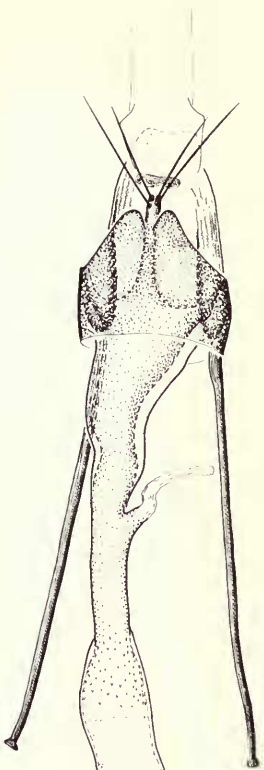
Figs 148–150 Female genitalia of *Daviscardia* species. 148, *beckeri*; 149, *lupulella*, holotype; 150, *mackiei*. Scale line = 1 mm.

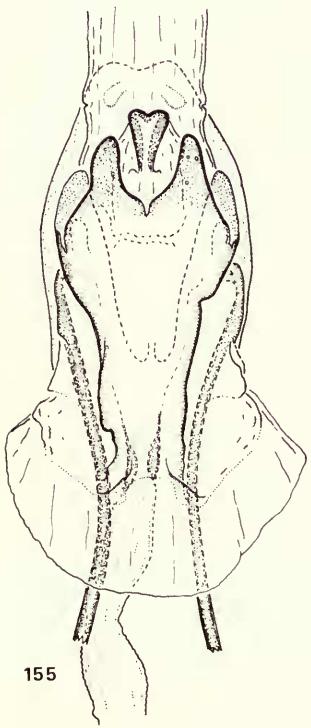


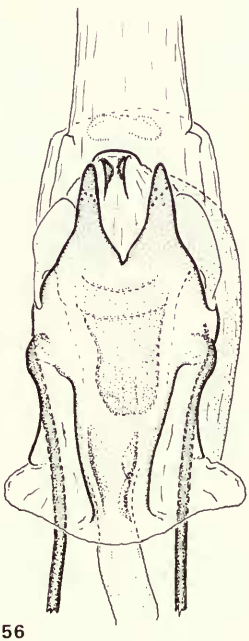


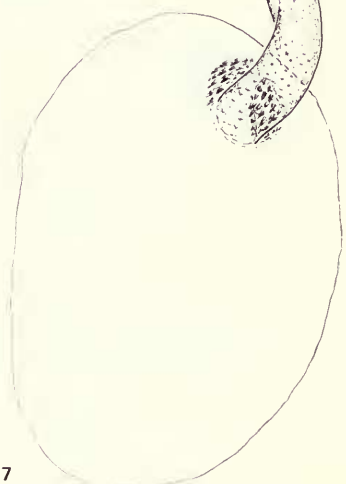
Figs 151, 152 Female genitalia. 151, *Daviscardia hypocritella*, holotype; 152, *Scardia alleni*, holotype. Scale line = 1 mm.



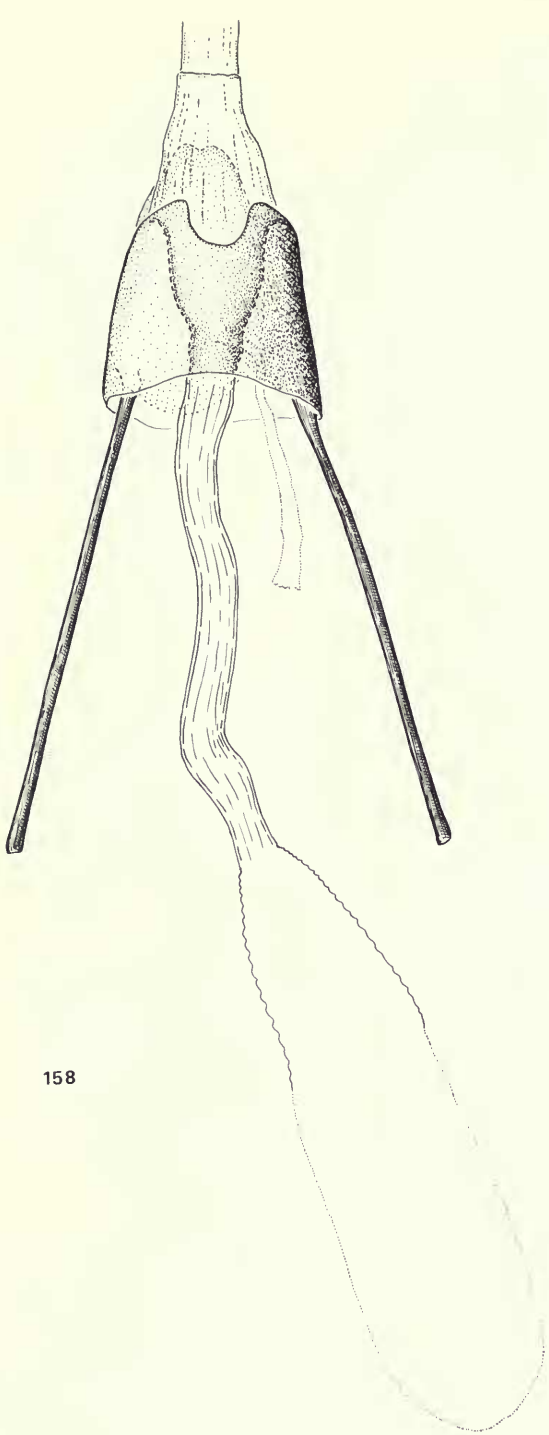




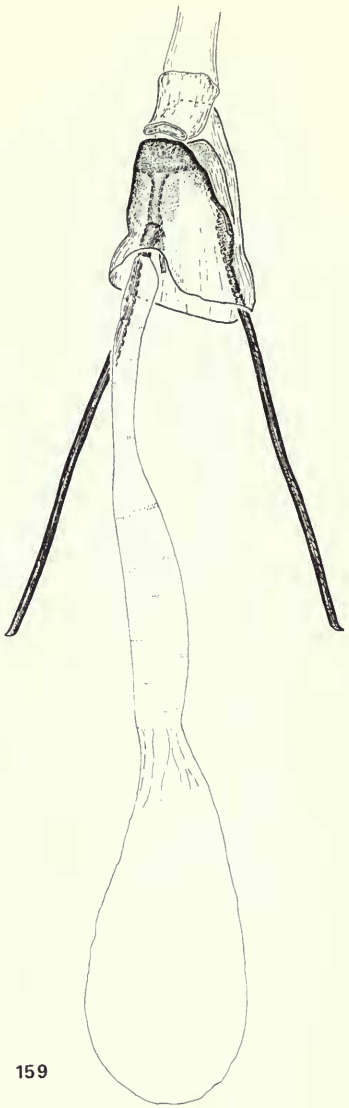




Figs 153–157 153–156, female genitalia of *Scardia* species (detail of eighth sternite). 153, *anatomella*; 154, *amurensis*; 155, *boletella*; 156, *caucasica*, paratype. 157, female genitalia of *Gentingia hollowayi*, paratype. Mixed scales.

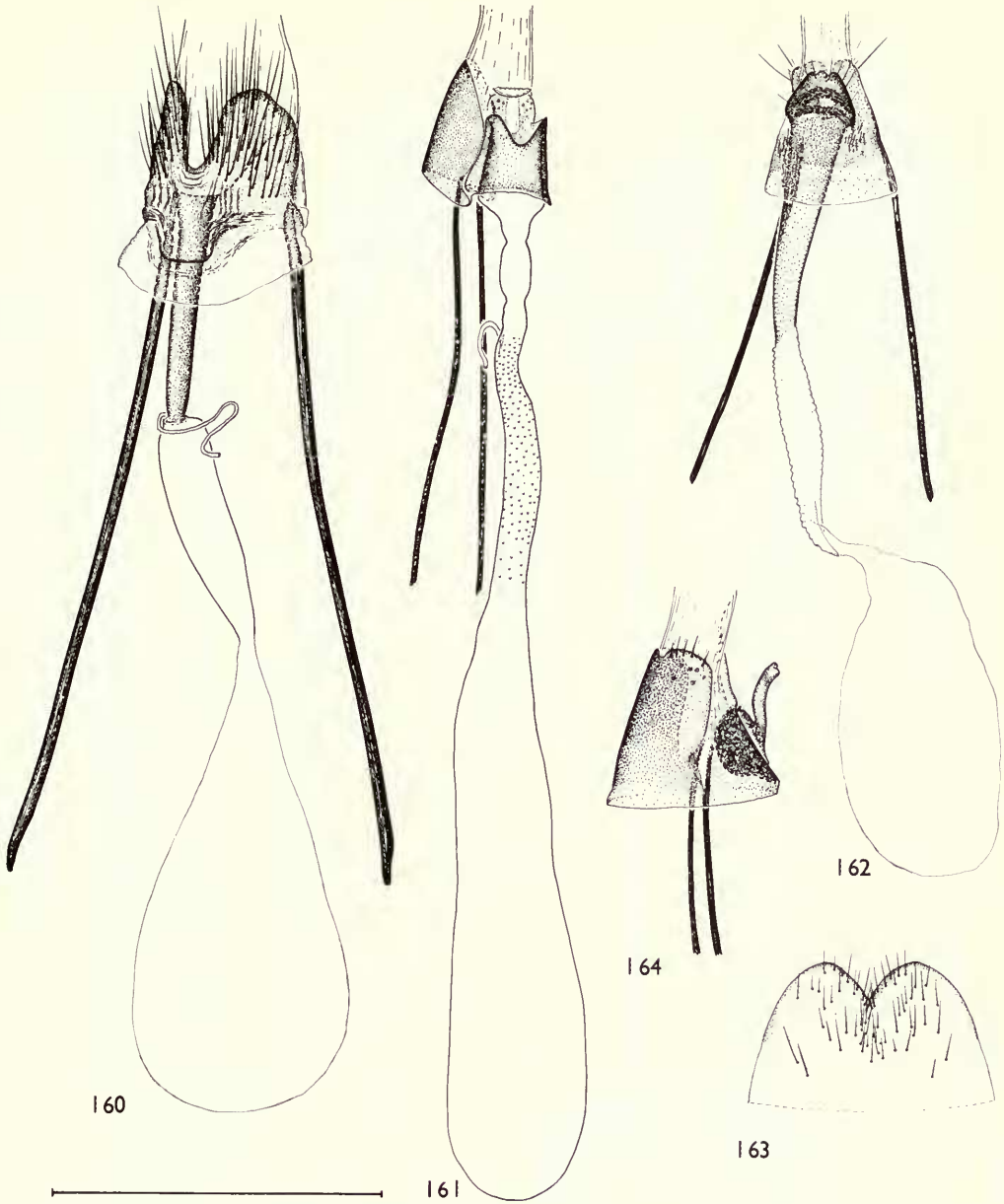


158

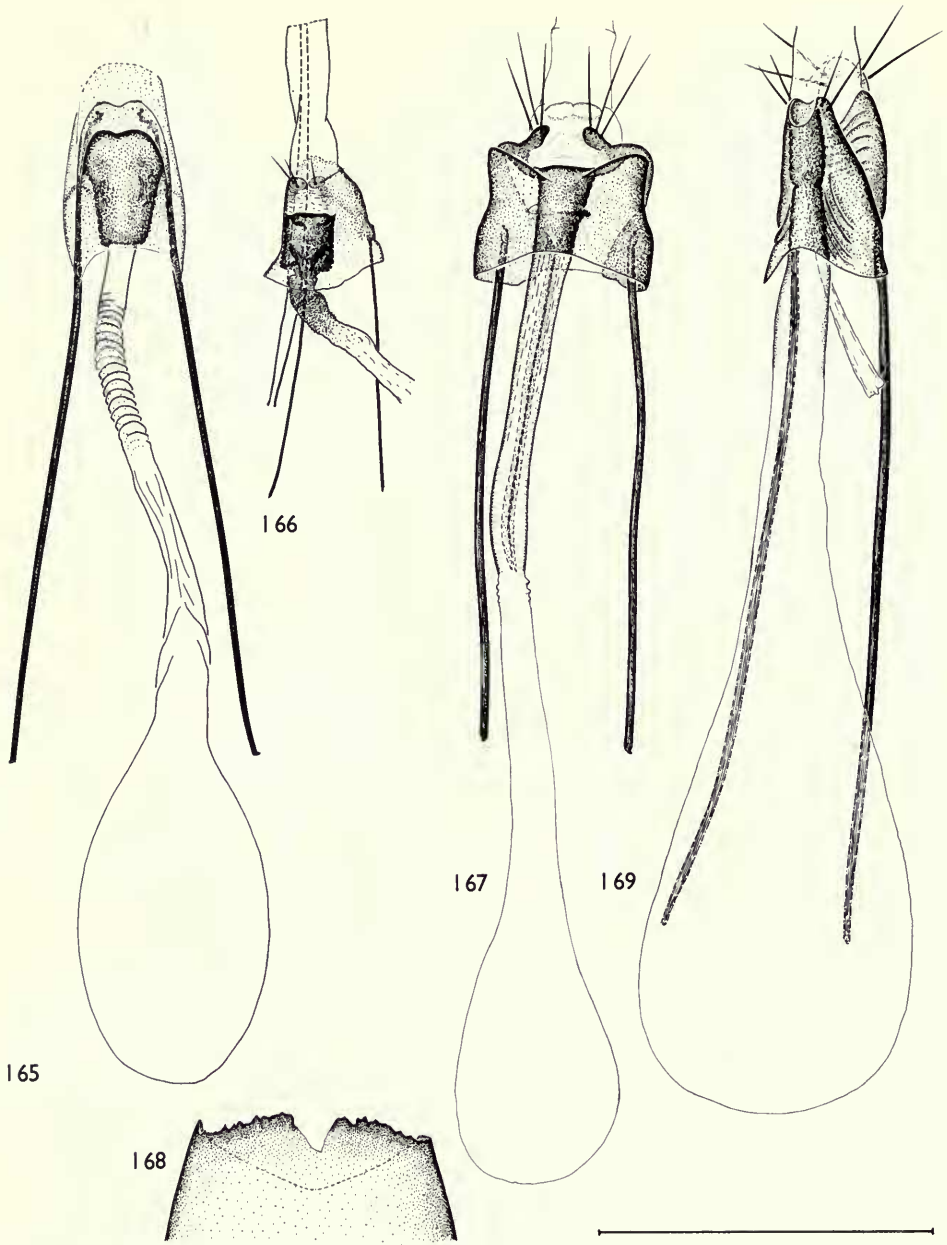


159

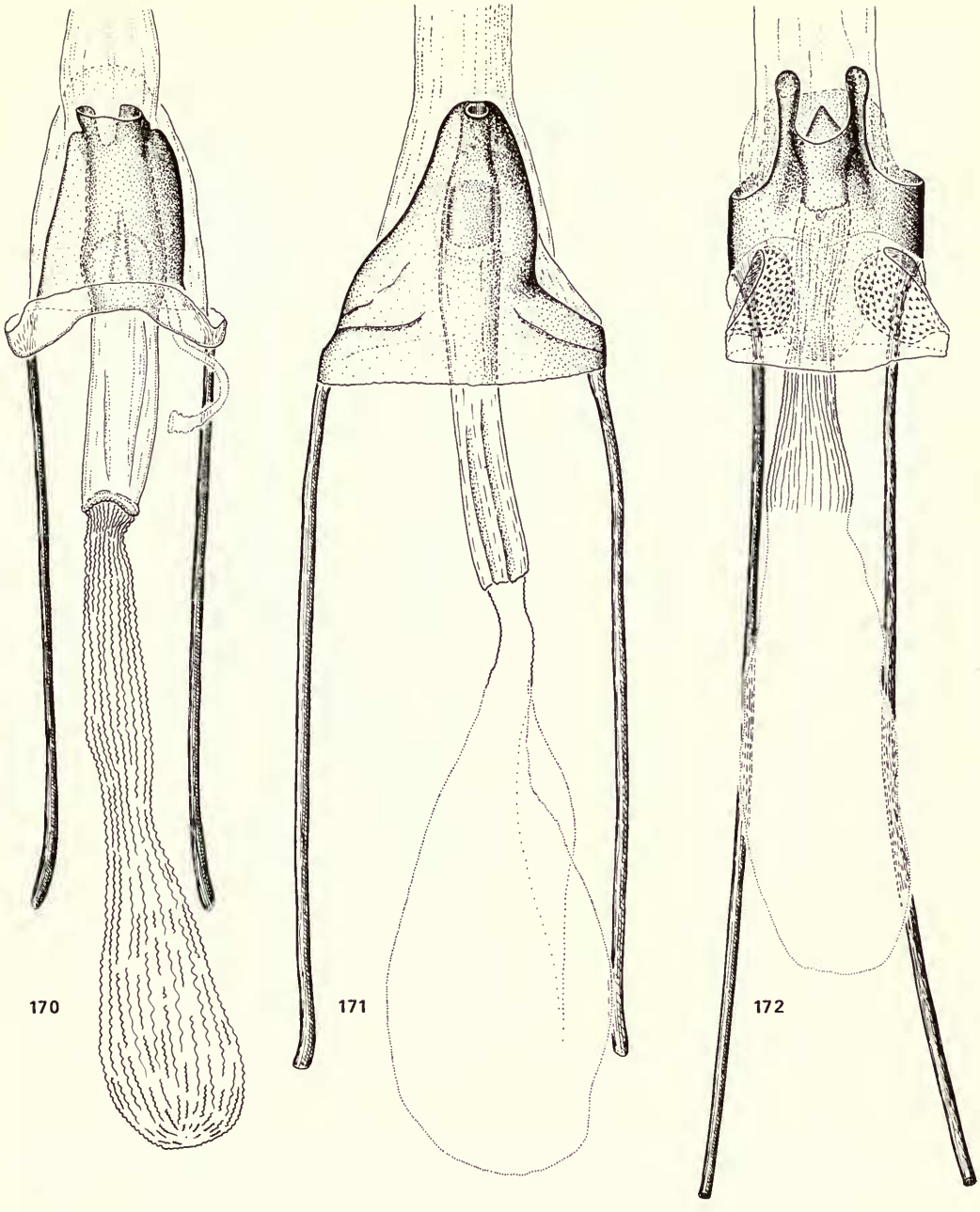
Figs 158, 159 Female genitalia of *Cranaodes* species. 158, *stereopa*; 159, *sequestrata*. Scale line = 1 mm.



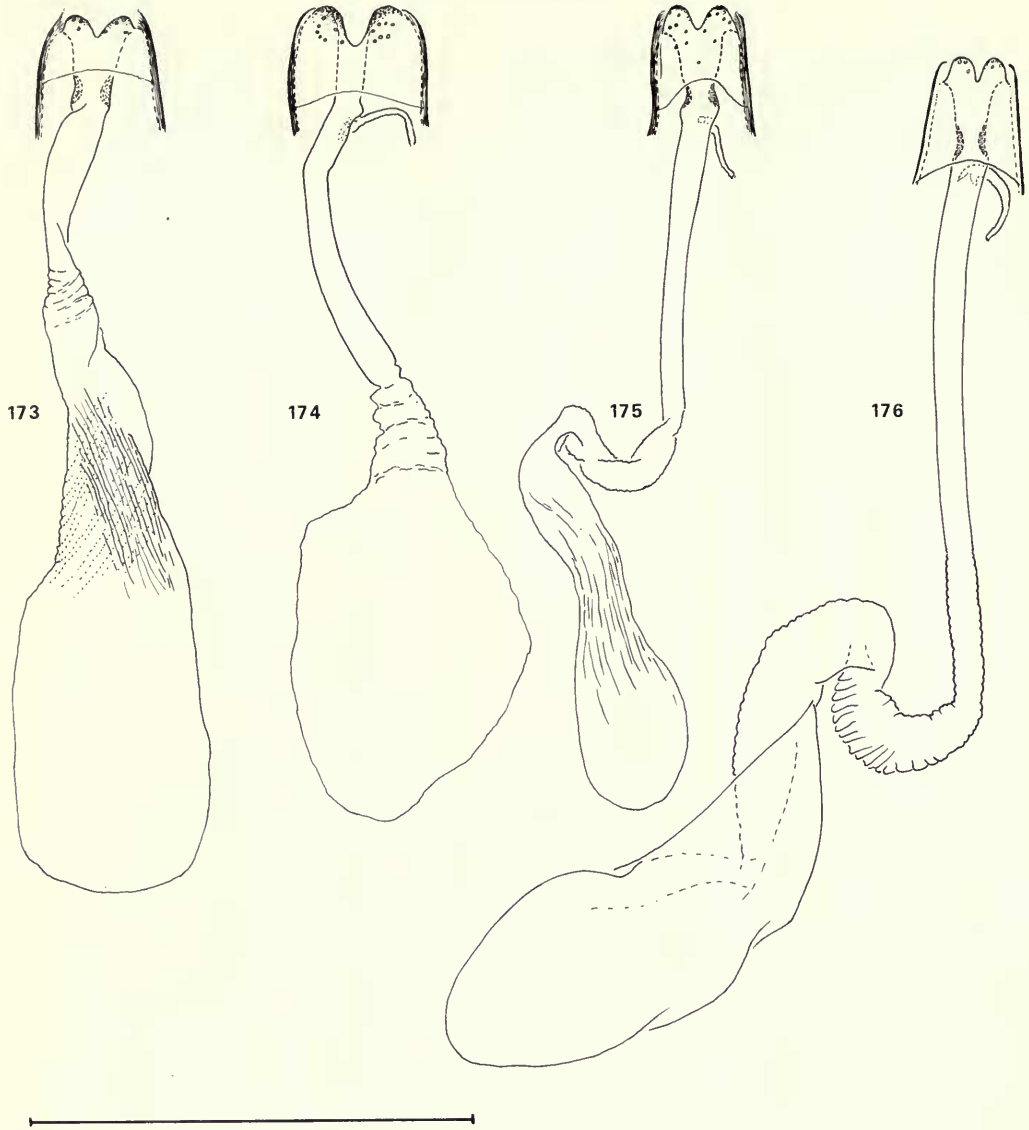
Figs 160–164 Female genitalia. 160, *Cnismorectis choritica*; 161, *Scardiella approximatella.* 162, 163, *Necroscardia* species. 162, *morticina,* paratype, with (163) seventh sternite; 164, *funeratella,* lateral view (pathological specimen). Scale line = 1 mm.



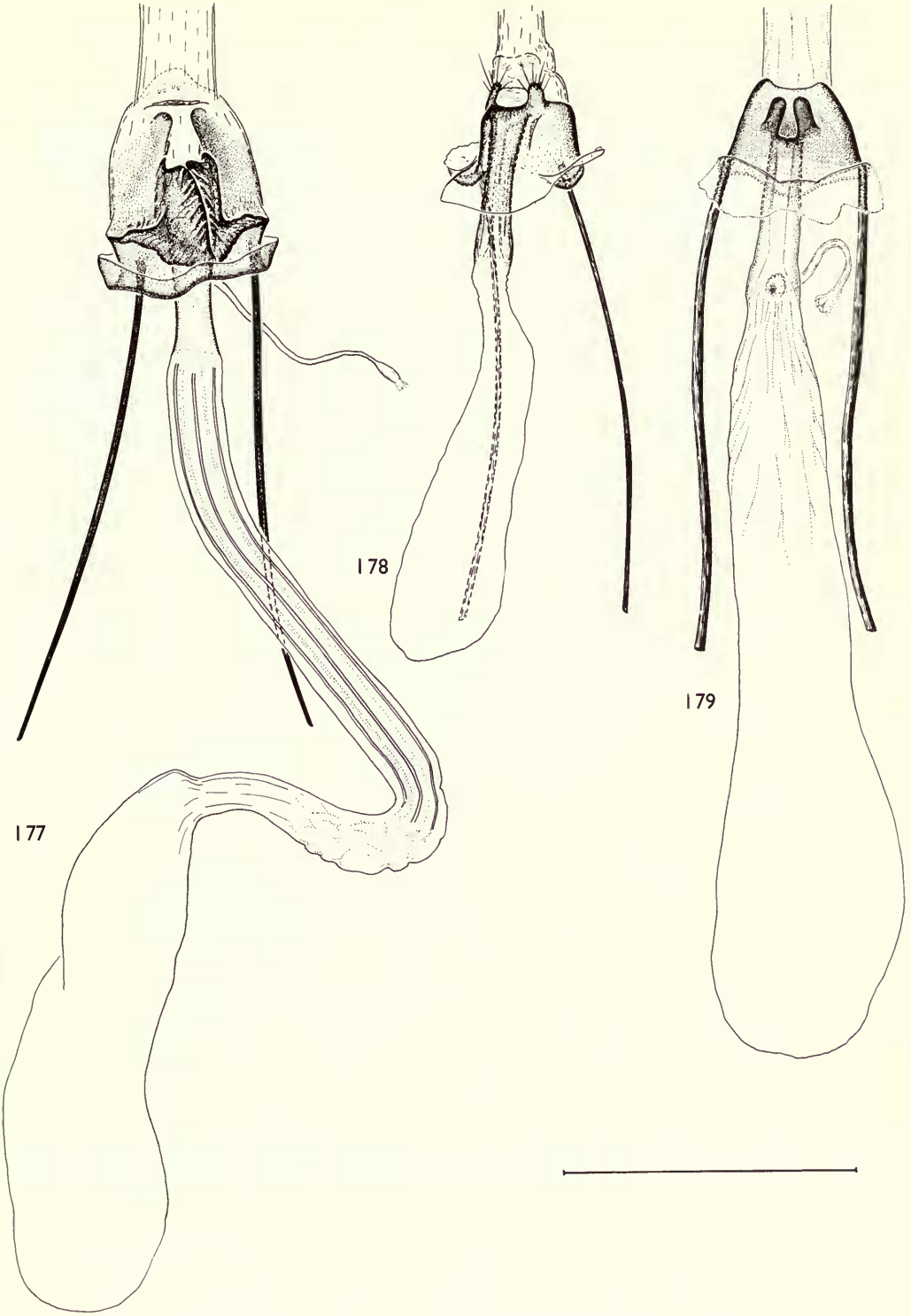
Figs 165–169 Female genitalia. 165, *Miniscardia minimella* (Brazil); 166, *Miniscardia* sp. (Arizona) (to half scale); 167–168, *Amorophaga rosemariae,* holotype, with (168) seventh sternite; 169, *Diataga leptoscelès*. Scale line = 1 mm.



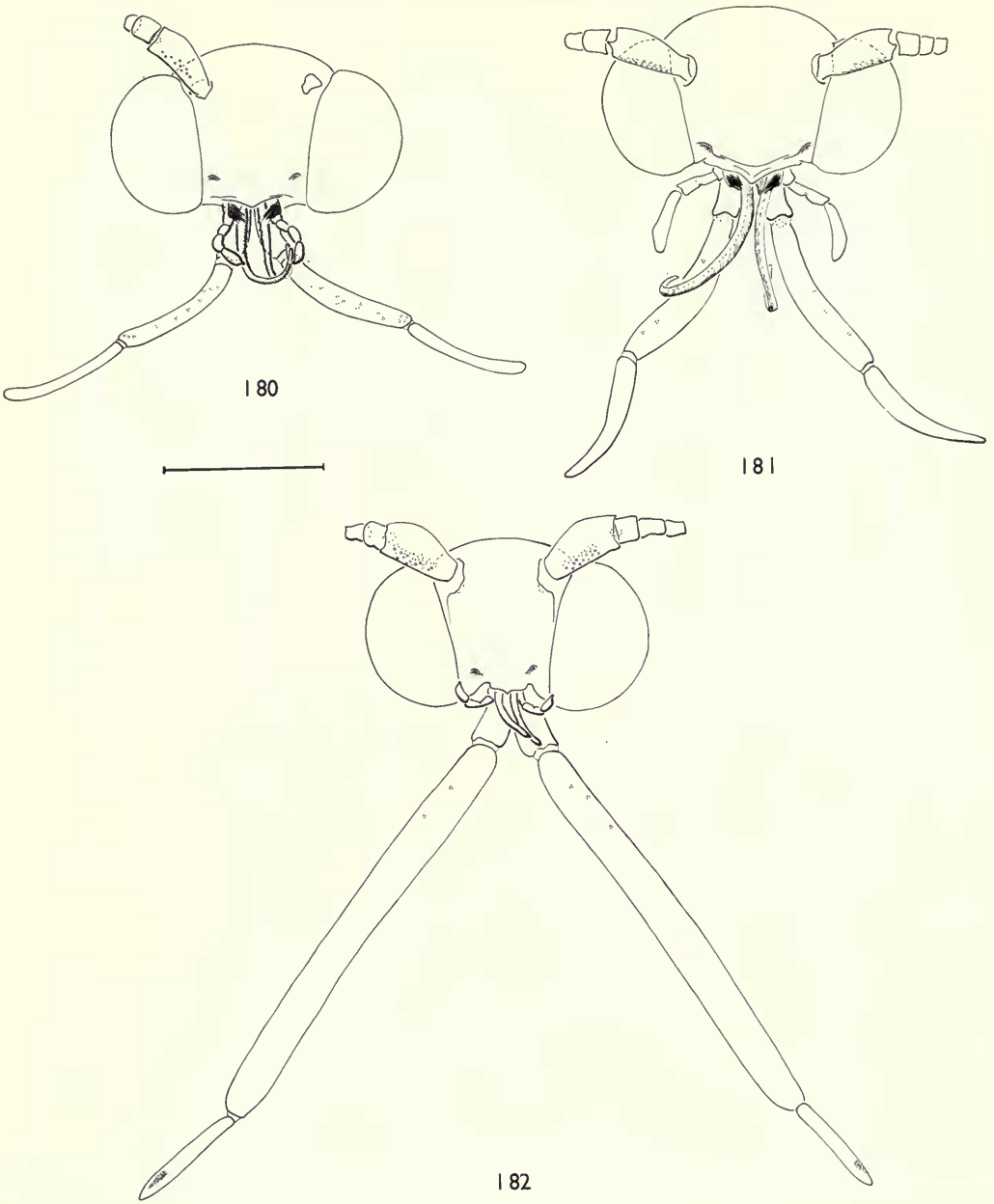
Figs 170–172 Female genitalia. 170, 171, *Diataga* species. 170, *mercennaria*, paratype; 171, *direpta*, holotype. 172, *Morophaga clonodes*. Scale line = 1 mm.



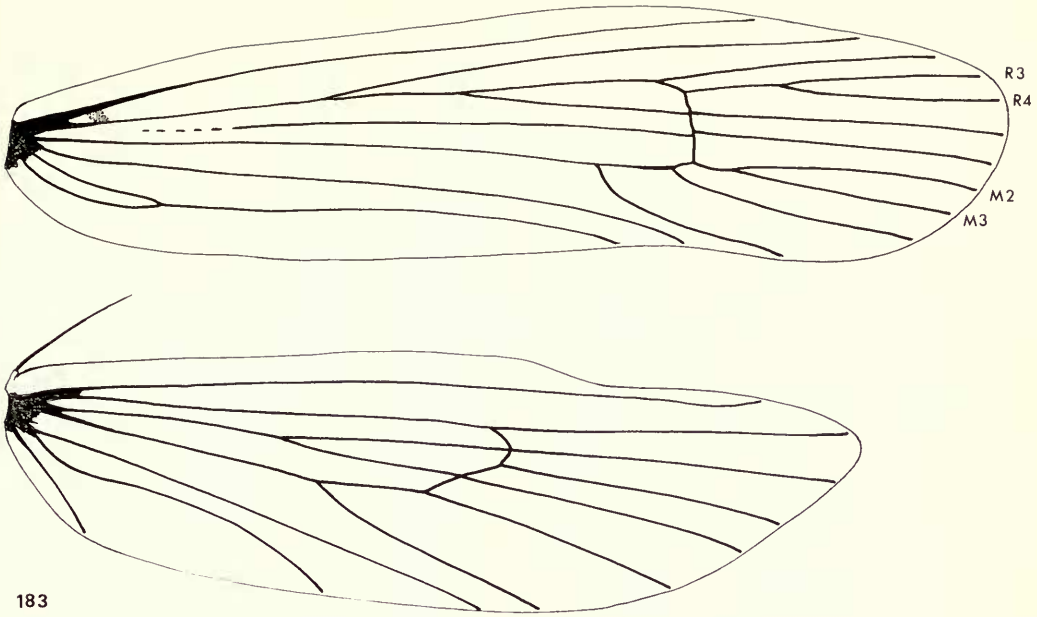
Figs 173–176 Female genitalia (outline) of *Morophaga* species. 173, *cremnarcha*; 174, *bucephala* (New Guinea); 175, *vadonella*; 176, *soror* (Angola). Scale line = 1 mm.



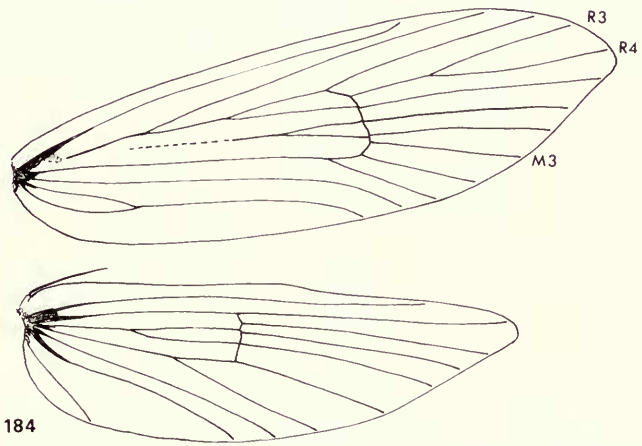
Figs 177–179 Female genitalia of *Morophaga* species. 177, *kobella,* holotype; 178, *fasciculata,* paratype; 179, *sistrata* (Sri Lanka). Scale line = 1 mm.



Figs 180–182 Denuded heads. 180, *Perilicmetis diplaca*; 181, *Tinissa insularia*; 182, *Cnismorectis choritica*. Scale line = 1 mm.

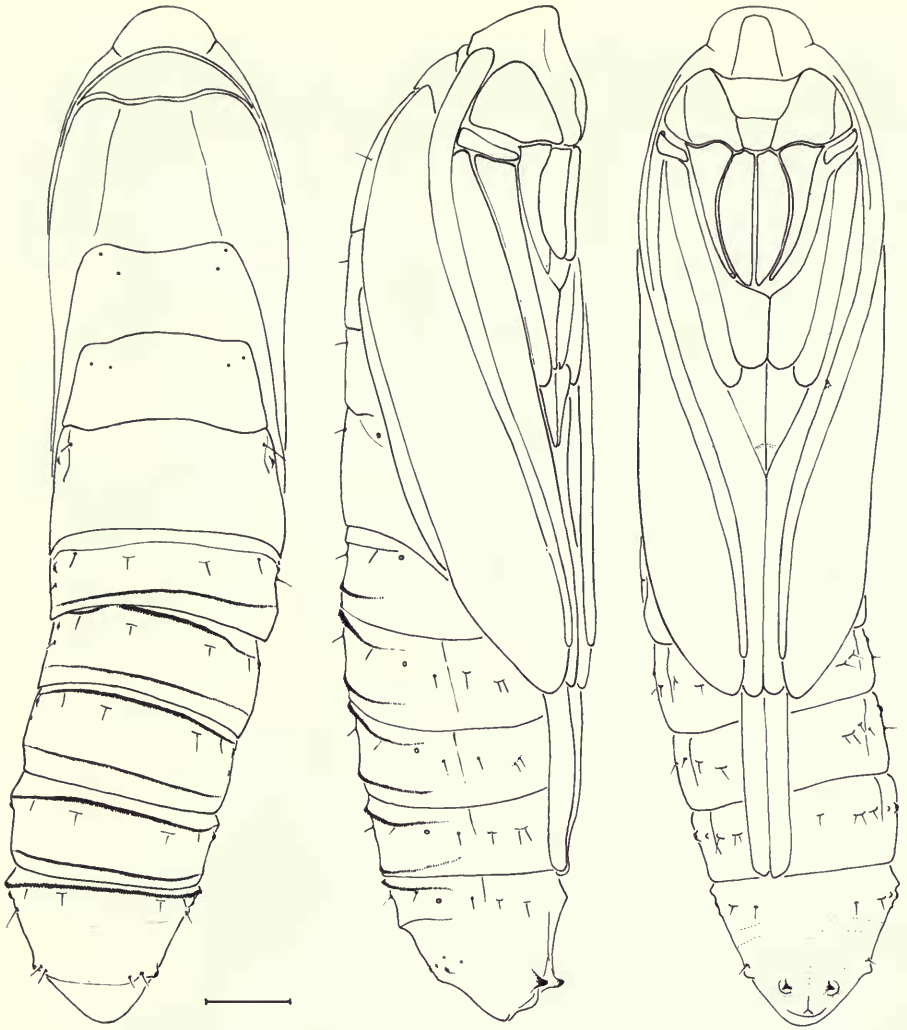


183

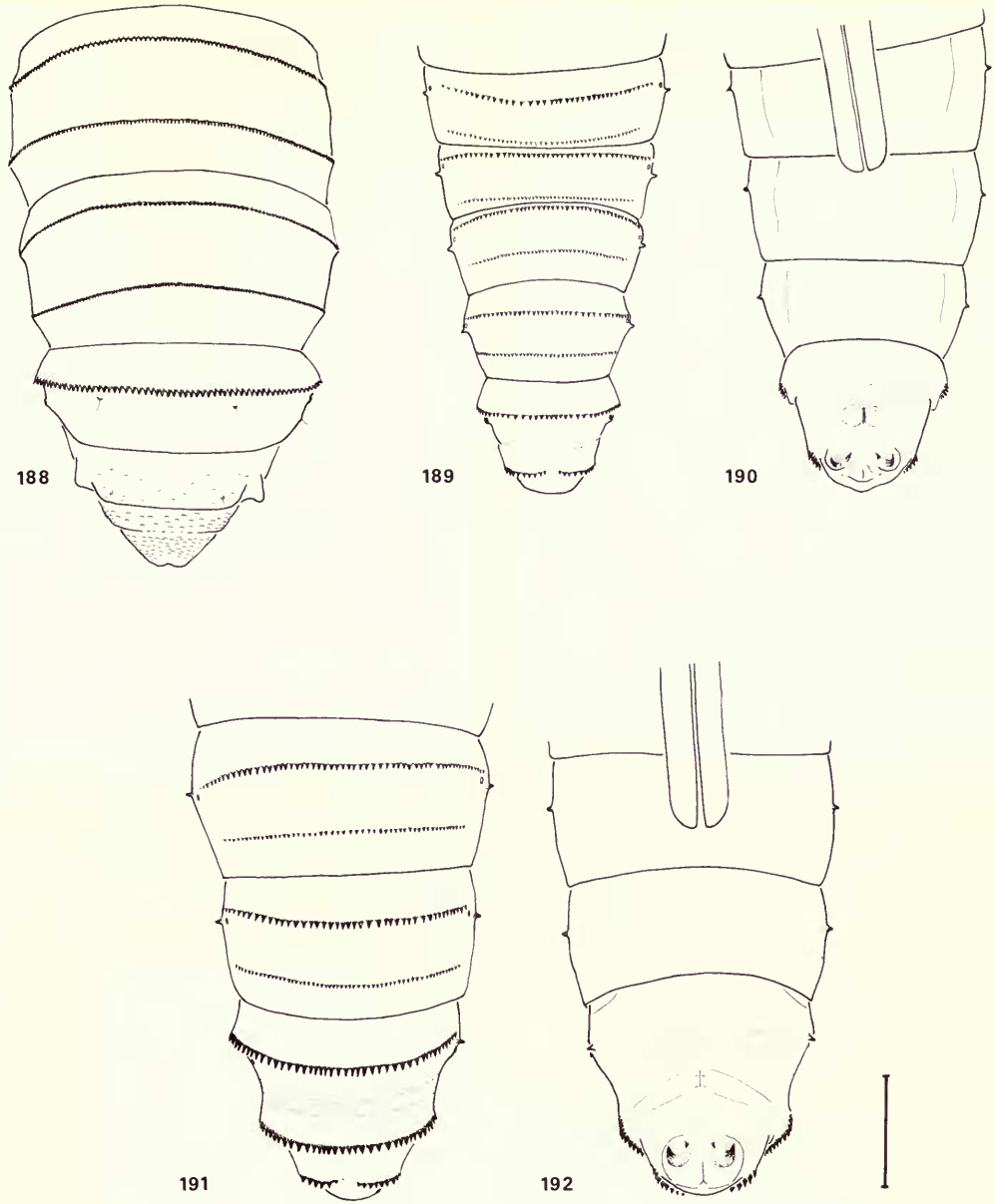


184

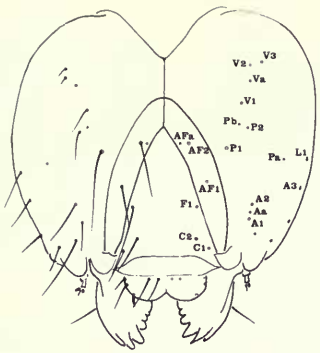
Figs 183, 184 Venation. 183, *Diataga leptosceles*; 184, *Gentingia hollowayi*, paratype.



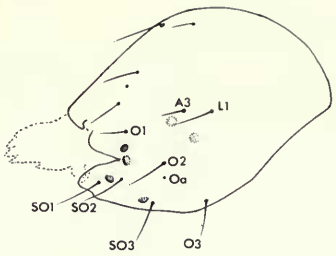
Figs 185–187 Female pupa of *Diataga leptosceles* (Costa Rica). 185, dorsal; 186, lateral; 187, ventral view. Scale line = 1 mm.



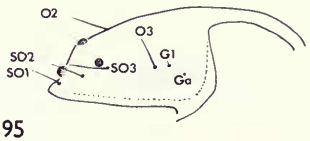
Figs 188–192 Pupae. 188, *Diataga leptosceles* (Costa Rica), male, dorsal view. 189, 190, *Morophaga choragella*, male, dorsal and ventral views. 191, 192, *Morophaga choragella*, female, dorsal and ventral views. Scale line = 1 mm.



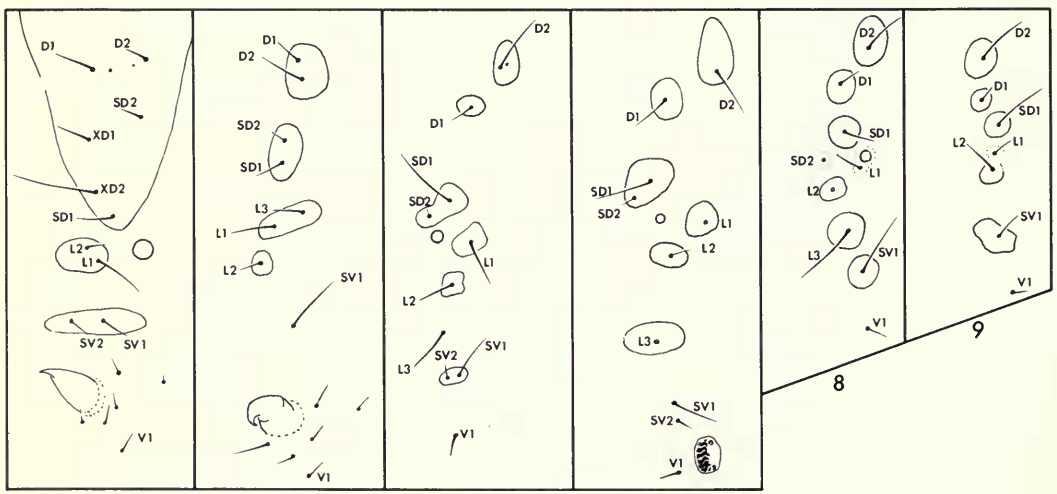
193



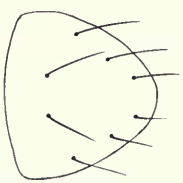
194



195



196



197

Figs 193–197 Final instar larva of *Diataga leptosceles* (Costa Rica). 193, head, frontal view; 194, head, lateral view; 195, head (part), ventral view; 196, setal map of (*P*) prothorax, (*M*) mesothorax, and abdominal segments *1, 6, 8* and *9*; 197, anal plate.

Figs 198–200 Habitats of Scardiinae. 198, montane himalayan oak forest in Nepal at 2700 m is type-locality of *Amorophaga rosemariae*. 199, tall mixed dipterocarp forest at 330 m in Brunei is habitat of *Tinissa* species (foreground clearing is helicopter landing-point: figures at edge of clearing give scale for 25-metre forest canopy). 200, comparatively stunted upper montane forest on steep 1700 m ridges in Brunei is habitat of *Cranaodes sequestrata* and an undescribed *Tinissa* species; lower montane forest on Gunong Mulu (distant ridge beyond low-lying cloud) is habitat of *Gentingia hollowayi*.

Index to hostplants and fungi

Abies 113
Acacia aulocarpa 130
Acer pseudoplatanus 109
agrifolia, Quercus 70
ash 92
atlantica, Pistacia 125
aulocarpa, Acacia 130

bamboo 108
Betula 91
birch 91
bracket-fungi 37, 132

Castanopsis 112
Coriolus 67
Cryptophorus volvatus 113

Daedalea microsticta 116
dead wood 75, 125, 132

edodes, Lentinus 69

Fagus 75
fomentarius, Fomes 90
Fomes 67, 91, 127
Fomes fomentarius 90
Fraxinus 92
fremontii, Populus 116
fungus 39, 80, 90, 92, 108, 122, 130

Ganoderma 67, 80, 91
gilvus, Polyporus 70

himalayan oak 112

kusanoana, Trametes 133

Lentinus edodes 69
Lithocarpus 70
Lupinus 70

microsticta, Daedalea 116
Morus 125

oak, himalayan 112

Parrotia 67
persica, Prunus 130
Picea 75
pine 88
Pinus 80, 113
Pistacia atlantica 125
plorans, Xanthoschisma 125
Polyporaceae 71
polypore 125
Polyporus 38, 67, 78, 80, 91, 116, 122, 127
Polyporus gilvus 70
Polyporus vulpinus 116
Populus 80
Populus fremontii 116
pore-fungi 75
Prunus persica 130
pseudoplatanus, Acer 109
Pseudotsuga 80

Quercus 67, 80, 125
Quercus agrifolia 70
Quercus suber 125

rotten tree stumps 122

Schima 112
shiitake 69
suber, Quercus 125
sycamore 109

Trametes kusanoana 133
tree-stumps, rotten 122

volvatus, Cryptophorus 113
vulpinus, Polyporus 116

Xanthoschisma plorans 125

Zelcova 67

Index to Lepidoptera

Invalid names are in *italics*; principal references are in **bold**.

Acrolophus Poey 43
Afrocelestis Gozmány 39, 43
Afroscardia gen. n. **110**
Agarica Sodoffsky 86
albipuncta Robinson 42
alleni sp. n. **90**
amboinensis Robinson 42
Amorophaga Zagulajev **111**
amurensis Zagulajev **89**
anatomella Grote **87**
angulatella Walsingham 43
approximatella Dietz **109**
araucariae Robinson 42
assamensis sp. n. **88**
astragalopa Meyrick **102**
Atabyria Snellen 120

bakeri Robinson 42
baliomicta Meyrick 42
beckeri sp. n. **81**
berkeleyella Powell **69**
bicolorella sp. n. **84**
bimendella Zeller **81**
boletella F. 89, **90**
boleti F., 1777 131
boleti F., 1798 91
borneensis sp. n. **126**
brasiliensis Zagulajev **117**
bucephala Snellen **123**
bucephala-group 121
burkerella Busck **70**
Bythocrates Meyrick **77**

capnochalca Meyrick **110**
caryophylella Busck 70
caucasica Zagulajev 92
chalcites Robinson 42
chaotica Robinson 42
chloroplocama Meyrick 42
chomatias Meyrick 123
choragella Denis & Schiffermüller **131**
choragella-group 130
choritica Meyrick **103**
cinerascens Meyrick 42
classeyi Robinson 42
clonodes Meyrick **129**
clonodes-group 129
Cnismorectics Meyrick **102**
coloradella Dietz **79**
compsacma Meyrick **118**
conglomerata Meyrick 43
convoluta Robinson 42
Cranaodes Meyrick **98**
cremnarcha Meyrick **122**
cryptophori Clarke **112**
cultellata Gozmány & Vári 42

Daviscardia gen. n. **78**
Diataga Walsingham **114**
diplaca Meyrick **93**
direpta sp. n. **120**
distracta Meyrick 42
dohertyi Robinson 42
Dorata Busck 104
drosocycla Meyrick **77**
Duomitella Koshantschikov 86

errandella Busck 70
errantia Robinson 42
eumetrota Meyrick 42

fasciculata sp. n. **133**
Fernaldia Busck 86
fiskeella Busck 87

formosana sp. n. **128**
frustraminis sp. n. **116**
funeratella Zeller **106**
fungella Thunberg 131
fungicolella Dumont 125
fuscofasciella Chambers **76**

Gentingia gen. n. **95**
Glessoscardia Kuznetzov 39
goliath Robinson 42
gracilis Walsingham 70

heterograpta Meyrick 42
hirsutevestita Walsingham 43
hollowayi sp. n. **96**
Hormantris Meyrick **102**
hypocritella sp. n. **86**
hyrcanella Zagulajev 132
hyrcanica Zagulajev **113**

indica Robinson 42
insignis Zagulajev 42
insularia Robinson 42
iranensis Petersen **66**
iriomotensis sp. n. **128**
isthmiella Busck **135**
iulina Walsingham **73**

japonica sp. n. **114**

kidukaroka Robinson 42
kobella sp. n. **133**
krakatoa Robinson 42
kurenzovi Zagulajev **75**

leptosceles Walsingham **115**, 116
Leptozancla Meyrick **134**
levidensis sp. n. **118**
lochaea Meyrick 43
luctuosa Walsingham 81, **82**, 83, 85, 95
lupulella sp. n. **85**

mackiei sp. n. **83**
maculosa Diakonoff 129
mediella Hübner 131
mercennaria sp. n. **119**
Microscardia Amsel 120
minimella Busck **104**
Miniscardia gen. n. **104**
Montescardia Amsel **74**
montium Walsingham **71**, 72
morellus Duponchel **125**
morellus-group 125
moriutii sp. n. **68**
Morophaga Herrich-Schäffer **120**
Morophagoides Petersen **65**
morticina sp. n. **107**
Moscardia gen. n. **93**

Narycia Stephens 43
Necroscardia gen. n. **106**
nigrocapitella Petersen 122
nimbiferum sp. n. **72**

oroya sp. n. **99**
Osphretica Meyrick 120

Palaeoscardiites Kuznetzov 39
palmodes Meyrick 42
Paraclystis Meyrick 43
parallela Robinson 42
Pectiniscardia gen. n. **101**
penicillata Gozmány **97**
Perilicmetis Meyrick **92**
perilithias Meyrick 42
pharetrodes Meyrick **135**
Philagrias Meyrick **134**
philippinensis Robinson 42
phrictodes Meyrick 42
poliophasma Bradley 42
Polymnestra Meyrick 108
polypori Esper 91
polysema Zagulajev 42
polystacta Meyrick 42
porphyrea Lower 129
pravatella Busck 76
Proscardiites Kuznetzov 39
prostylias Meyrick **101**
pythium sp. n. **72**

radulella sp. n. **80**
relicta Koshantschikov 91
renitens Meyrick **94**
rigida Meyrick 42
rosemariae sp. n. **111**
rotundata Matsumura 123
ruwenzorica Gozmány 42

saccharata Meyrick 43
Scardia Treitschke **86**
Scardia sensu lato **135**
Scardiella gen. n. **108**
Scardiites Kuznetzov 39
Semeoloncha Gozmány 39, 97
sequestrata Meyrick **100**
sistrata Meyrick **127**
sistrata-group 126
soror Gozmany **124**
spaniastra Meyrick 42
sp. (Daviscardia) **84**
sp. (Miniscardia) **105**
stereopa Meyrick **98**

talaroscia Meyrick **134**
talyshensis Zagulajev 132
tessulatellus Zeller **74**
tholerodes Meyrick **135**
Tinissa Walker **108**
torvella mysorensis Robinson 42
torvella torvella Walker 42
transversella Walker 42

ussuriensis Caradja **67**, 68

vadonella Viette **124**
varna sp. n. **95**

yaloma Robinson 42

zelotica Meyrick **134**